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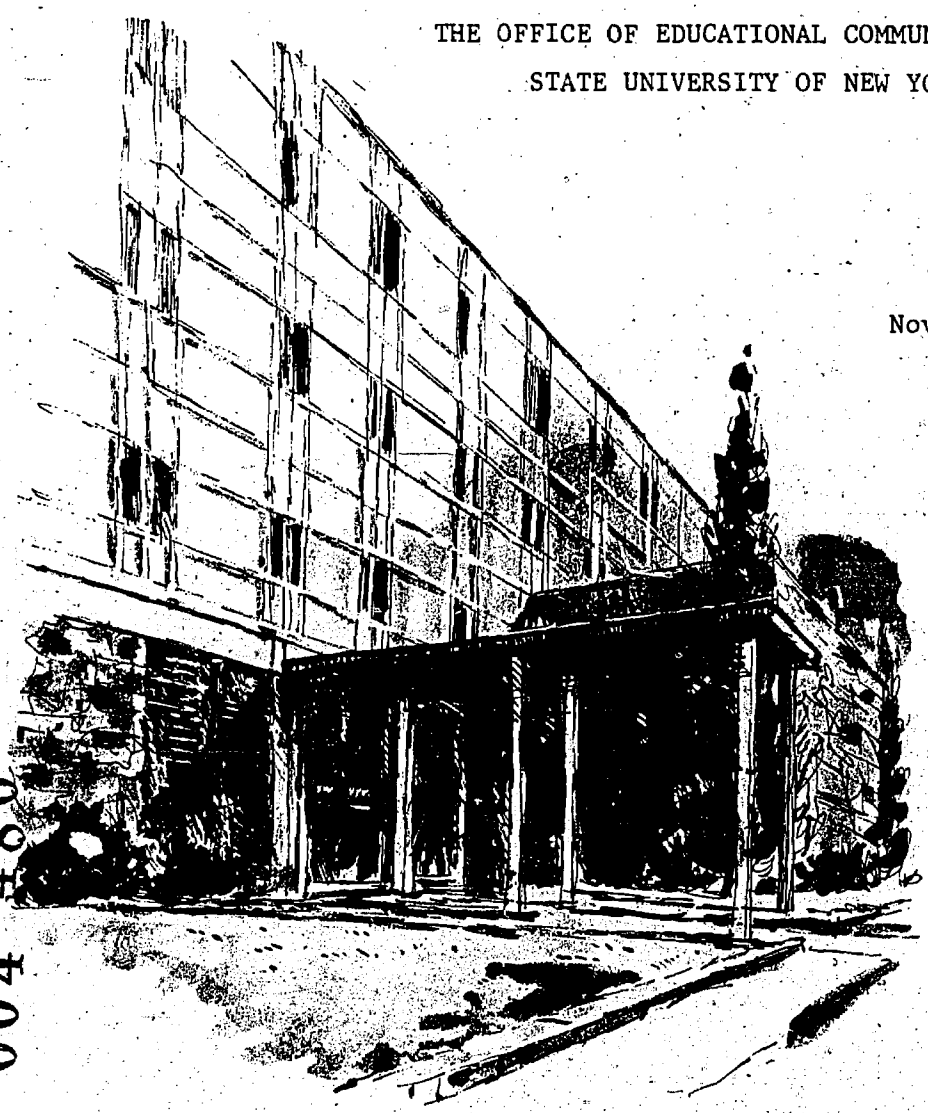
ABSTRACT

A detailed description of the operating practices of a computerized book-ordering and processing center for the State University of New York (SUNY) and a plan for implementing such a center are presented. The center is designed to receive orders for purchasing books that are prepared by the member libraries, transmitted to the center over communication lines, and issued to vendors by the center. Vendors ship purchased items to the center, the books are processed centrally and then distributed to the ordering libraries. As a byproduct of its need to provide catalog cards for purchased books, the center will naturally accumulate a file of machine-readable catalog data on purchased items which, since it is also natural to record which library purchased the item, can serve in time as the basis for a machine-readable union catalog for the SUNY statewide holdings. Three phases of implementation are described, and the report is organized around this chronological sequence to provide an evolutionary view of what will take place. The first phase focuses on placing the installation in operation. The second phase represents a period of restricted service--full service of specified kinds to a limited number of libraries. Phase III is the full implementation of all services to the entire SUNY network. (Author/SJ)

A PLAN FOR A LIBRARY PROCESSING CENTER FOR THE STATE UNIVERSITY OF NEW YORK

Report to

THE OFFICE OF EDUCATIONAL COMMUNICATIONS
STATE UNIVERSITY OF NEW YORK



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Arthur D. Little, Inc.

PREFACE

The size and quality of a university's library has long been recognized as a major factor contributing to its achievement of academic excellence. As part of a long-range plan, the campuses of the State University of New York have embarked on a program to expand and strengthen their library holdings. In 1966, the libraries purchased a total of roughly three-quarters of a million new volumes, making the State University system, already one of the world's largest library complexes, into one of the most vigorously expanding ones as well.

To manage and operate this complex, the State University library system currently employs about 950 professional and clerical persons concerned with library operations. In the light of expanding book budgets and the scarcity of qualified personnel, the SUNY libraries are facing a major problem in acquiring and processing books, especially in making new and current volumes rapidly available for use by the educational community they serve.

Unlike most supplies and equipment, books are not finished products ready for use when they are purchased by libraries. Between the time a book is received by the library and its placement on the shelves a number of operations, some of them time consuming, must be performed. The library must locate its copy of the original order and note the receipt of the book. It must follow rigid accounting procedures necessary for the handling of public funds in arranging for payment of the book. Cataloging of the book must be done, and catalog cards must be filed to permit users to locate the book and allow librarians to manage the collection. A book pocket and borrower's card must be constructed and affixed to the book. The spine of the book must receive a label which contains classifying information. In addition, damaged or unordered books must be returned to vendors with appropriate credit arranged. All these processing activities are steps which transform the purchased book into the final product to be borrowed and used by the library's clientele.

Each of the SUNY libraries currently performs these processing activities independently. Understaffed and faced with the need to maintain essential services to their customers, the libraries are finding it difficult to process books as fast as they are purchased. Indeed the individual librarians have projected figures for staff requirements (in the presence of these expanding purchases) which show drastic differences between the current full-time staff and the number needed by 1970. Most of the libraries feel the need to at least double their staff within this planning period.

To the extent that the SUNY libraries can share a common book ordering and processing plant without losing important freedoms, they can capitalize on production economies and efficiencies in the book processing activity which are an outgrowth of the scale of the shared operation. This report describes both the design and a plan for the establishment of such a centralized library processing center for the SUNY library complex.

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SUMMARY

The summary to follow is presented in four parts. The first part "Overview" records important assumptions and findings which specify or take into account the environment in which the center is to begin, to change, and to flourish.

The second part "The Processing Center" is a terse encapsulation of the results of the design of the processing center.

The third part "Schedule" summarizes important events which are planned in the center's establishment.

Finally, "Summary Budgets" presents a review of the expenditures for the development and operation of the processing center.

OVERVIEW

INTRODUCTION

This report contains a detailed description of the operating practices of a computerized book-ordering and processing center for the State University of New York and a plan for implementing such a center. The center is designed to receive orders for purchasing books that are prepared by the member libraries, transmitted to the center over communication lines, and issued to vendors by the center (which does the necessary accounting). Vendors ship purchased items to the center, which is located in the environs of New York City, the books are processed centrally and then distributed by the center to the ordering libraries.

The center is designed to accomplish this function for the 60 libraries of SUNY at a rate that will approach one million volumes per year when the center is in full scale operation in a few years. As a byproduct of its need to provide catalog cards for purchased books, the center will naturally accumulate a file of machine-readable catalog data on purchased items which, since it is also natural to record which library purchased the item, can serve in time as the basis for a machine-readable union catalog for the SUNY statewide holdings.

Three phases of implementation are described, and the report is organized around this chronological sequence of events in the interests of providing an evolutionary view of what will take place. As is to be expected, the first phase will focus on placing the installation in operation and involves decisions like where to locate the building, the design and field testing of computer programs, and the acquisition of staff and equipment. The second phase represents a period of restricted service -- full service of specified kinds to a limited number of first customer

libraries. Phase III finally represents the extension of service both in kind and in number, as the center moves to serve all the libraries in the University. We have felt it important to highlight the sequence of steps, in part to emphasize that a center with processing volume like the one envisioned cannot economically be placed into full operation overnight.

SCOPE

To many readers of this report, we recognize, there are diverse topics which interest them far more than the sequence of tasks and the planning details. Librarians who are considering the use of the services offered would prefer to see the center described from the use point-of-view. The planners of the University and all those interested in the vital trends towards mechanization of the library resource might prefer to see the center's role as a system element highlighted. Managers may wish to hear more about the operating problems envisioned when the center moves into day-to-day operation. We recognize these and many other legitimate and significant perspectives, and occasionally the discussion or description elaborates on an item of interest from such a point of view. Thus in the description of Phase II we devote a section to the accounting practices of the center and their relation to the requirements imposed by New York State's laws and the policies of cognizant agencies. But as a rule, it has not been possible to depart too far from our key objective -- the presentation of a detailed implementation plan and operating design.

There may be merit, therefore, in describing in advance certain attitudes which governed the study or emerged after careful consideration by us. For example, it was certainly outside our scope to advise the University on the route they should take toward their stated objectives of an integrated machine-using library system. Our task was to assume that resources would be available for the book-ordering and processing center first and that other steps would follow. Similarly, it was outside our scope to contemplate other forms of book-ordering centers; our task was to develop the best feasible one given long-term objectives, current technology, and known trends. Within these boundaries, we have taken the view that the crucial question was the technical feasibility of creating the computer system capability in a fashion that would match developments that are expected almost for certain during the period when the center is building its services.

Sooner or later, communication links among libraries will find flourishing use. In time, regional centers of computing and data-processing service for the nearby library community will be natural elements of a system. The Library of Congress catalog data will at some point (we expect immediately) be captured and used for union catalog and reference purposes. Individual universities - especially the larger ones with strong library schools - can almost certainly be expected to move vigorously to expanded interest in local and regional exploitation of information

technology and of whatever data bases can be made available.

All these trends are simultaneously in confluence. The impediments to vigorous action have almost entirely dissipated in the SUNY environment. It is within this context that our plan for a book-ordering and processing center has been devised. The plan carefully states what the center should do consonant with these trends. We have seen no harm emerging from rapid and forceful action by the center's management in areas that may very well lie outside their prerogative. For instance, capturing who purchased a book is mandatory in the center's operation for obvious reasons. Retaining a record thereof after the book has been shipped to the ordering library is not strictly the center's job any longer. Yet we have assumed that the center will attend to retaining this union catalog information until such time as another unit of the complex (regional centers, for instance) is in a position to assume that role.

Similarly - given some choices we made as to the computer system configuration at the center and its mode of operation - the possibility of libraries interrogating the center to locate the whereabouts of a borrowable copy of a book was not ruled out. All our planning and designing was based on the premise that the center should be capable of exercising a leadership role in areas like these if called upon to do so. Such planning minimizes the risk and maximizes the likelihood that the center's operating procedures will dovetail neatly into whatever unified configuration finally emerges in the State of New York. It should not be construed as an effort by us or by the agency which sponsored our effort to impose a responsibility structure on the emerging system.

By this comment we mean to suggest the following. It might be wisest for the State University to empower one of its strong library schools to build itself into a regional information center first, then to build an ordering and processing center as a satellite of that unit, and finally to replicate the information center in other regions of the state via hookups to the ordering center. It might be wisest for the trustees to present the plan herein to a private enterprise and allow the enterprising vendors to build "centers" like this one capable of interfacing with SUNY long-term plans. It might be wisest to implement this center at once in the interests of demonstrating to the legislature and the tax-paying public the University's concern for and interest in the massive savings which immediate concerted effort can supply. We have not studied nor weighed in our own minds strategic alternatives like these which are, we believe, still open at the highest decision-making levels.

PREMISES

We present a plan for a book-ordering and processing center in a language, and with attitudes, that reflect our basic premises:

1. We begin with the premise that the center is the first step toward longer range goals and that it is to be implemented in the immediate future.

2. It shall be capable of serving as the cornerstone for other unifying activities which SUNY may and probably will undertake. We have been guided in this respect by two specific goals expressed by the Board of Trustees in 1966 Interim Revision of the Master Plan of 1964 for the State University of New York. These recommendations were:

   - that there be established a state-wide library communications network, connecting all campus libraries in State University with capability for remote station access to a central computing facility, with visual image tranmission and reproduction facilities at each station;

   - that there be established a central library service facility for acquisitions, cataloging and preparing new library materials; operating a central computational and rapid retrieval information service; and for maintaining a central catalog of all library monographic and serial holdings.

3. Actions by the center which exceed its prerogatives are temporary steps which can later be shifted away from the center or concentrated there as SUNY wishes.

4. The center's primary responsibility is to provide faster, more economical service in the ordering and processing of books. It is not the responsibility of the center to absorb all the ordering, processing, accounting and cataloging activities of the library system.

5. The center shall not by its operations or rules restrict the freedom of the member libraries to order or purchase books of their choosing, nor is it the function of the center to administer the book purchase budgets of the member libraries.

6. All activities like maintenance of union catalog information, facilitating inter-library loan requests, etc. which can be built upon the center design developed here are secondary responsibilities. But they are activities which the center must (as a major element of the data-processing and communications complex) have the competence to appreciate, assess, and contribute to while the planning for these later steps takes place.

7. Although we are aware of the interest in centralizing two other major book-purchasing activities in New York State (the public school libraries, the public libraries) our design is entirely directed toward meeting the needs of SUNY. The suggestion has been made that these other activities share some of the resources of the SUNY center. Our discussion and planning is quite independent of these possibilities: we neither depend on such sharing to reduce some of the costs (which it probably would from the standpoint of the State as a whole) nor do we have any basis for advising opposition to the limited use, by other units, of the SUNY center's resources.

8. Finally, we have assumed that the cost of developing and running the center will be underwritten by the central administration of the University. While other arrangements may be chosen when final decisions are made, the center design presented here is consistent with this premise -- if only in that central financing will avoid premature impediments to casting the center in the role of unifying agent for the SUNY library complex as a whole. Because of this premise we have eliminated consideration of bookkeeping mechanisms for apportioning the center's costs among member libraries. One consequence of this is that machinery is not available in the current design for segregating charges to the community colleges which may participate. Thus the assumption extends to assuming SUNY will support the processing costs for books purchased through the center by the community colleges.

FINDINGS

Within this framework, the following points deserve to be highlighted as the summary findings of our planning study:

1. The processing center plan developed here is sound, workable, and immediately implementable without technical impediments.

2. While there may be emotional impediments to implementing the center at once and giving it a certain amount of freedom to exercise its secondary responsibilities, we have not been given any clues of strong opposition by the persons in the SUNY library complex we interviewed. We were sensitive to the possibility that the time for unifying action might not

be at hand, but we obtained no clues to support this view.

3. Despite the fact that the center design presented here involves significant capital investment and operating costs, its implementation will provide substantial economies to the state. Given accurate data on current costs, an argument for implementing the center as given here (including all of the features which tie the design into future plans) can be built on purely economic grounds. Our data on current costs for ordering and processing a book are inadequate for proving the point.* However, the evidence is persuasive that savings per volume purchased through the center will fall in the vicinity of two dollars per book.

4. The center is expected to halve the average time between ordering a book and its placement on the shelves. The time savings arise principally from the rate at which items are shipped from vendors to the center, from the streamlining of the processing activity obtained by using high efficiency methods, and from efficiency in the accounting and managing of orders-in-process.

5. The center is expected to be operative within 15 months of the date of authorization, providing Phase II service to 25 of the libraries. This service is a full book-ordering and processing service for American books-in-print.

6. The above Phase II service is expected to last for about 9 months. During this period, the center will be approximately self-sufficient with respect to its operating costs. That is, it will provide SUNY with demonstrable savings on books purchased through the center even though the activity of the center is not yet at full peak. Continued investment is required, however, to prepare the center for the full service to all members which begins with Phase III.

7. Phase III operations, after an initial period, are expected to be fully self-sufficient. That is, the savings from center purchasing and processing both repay the current operating cost and amortize the capital investment.

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*Good estimates of the center's costs for book ordering and processing are presented in the report. Uncertainty hinges on knowing what the current costs are now and on assessing how much accounting the libraries will continue to do when orders are channeled through the center. Of major interest in developing a savings estimate are 1) the library's cost to issue an order and 2) the library's cost to move a fully-processed book onto the shelves (filing catalog cards, etc.)

8. We have regarded the establishment of a steady Phase III book-ordering and processing operation as the boundary of our study's scope. But trends thereafter can also be foreseen, albeit dimly.

   a) Center management is likely to be in close liaison with new ventures in interlibrary cooperation that are information-technology based. Such liaison does not imply dominance or leadership; the center will be a resource capable of contributing to developments like union catalog management, interlibrary communication, cooperation, and loan, interfacing of component systems, etc.

   b) The center is also likely to be a focal point for contact between SUNY and the analogous systems in other states that will be maturing at about that time.

   c) Federal systems are likely to interface with SUNY via the center if only because it represents a unique point of contact which has by then been perceived and used as a major channel between SUNY and the outside world.

   d) SUNY's leadership in integrating a library system statewide and introducing new technology is likely to lead to serious attrition in personnel, as other jurisdictions embark on programs of great novelty just as SUNY's center is approaching a steady state.

With these general comments, we proceed in the next section to summarize the results of the planning study proper, presenting detailed statements about the design and implementation of the processing center.

THE PROCESSING CENTER

INTRODUCTION

The establishment of a centralized processing center to handle the majority of book orders generated by the SUNY complex of libraries is a massive and challenging task, partly because such a center would be the largest of its kind in the United States. The plan calls for the center's establishment in a series of phases, to allow for evolution into the ultimate operational system.

Currently, each library places orders for books independently with selected vendors and publishers. When the books are received by the libraries they must undergo a processing function before they can be placed on the shelves. A major part of this processing is the cataloging of the book. In many cases, catalog cards are ordered from the Library of Congress when they are available. This process represents an entirely separate ordering function - a separate source, a separate payment, and distinct accounting are involved - and the need to await receipt of the cards contributes to the delay between the placement of an order and the shelving of a book in the library. Sometimes original cataloging is done by the individual library, and when this happens a great duplication of effort occurs among the SUNY libraries, for they order the books and catalog them independently. In a series of questionnaires and interviews with many of the libraries, we learned that over half the time of professional staff and over two-thirds the time of clerical staff are spent in acquiring and processing books. Evidently cataloging, acquiring and processing of books are major enterprises in this library complex.

While estimates vary, our study has indicated that the current cost of processing a book is above $4.50.

A substantial saving in processing cost is expected as a direct result of the centralized processing center, through a reduction of the future personnel requirements in the library system. Our study of twenty-five libraries revealed a projection of staff requirements from 725 in 1966, to over 2,000 in 1970. We believe the processing center will allow a reduction of at least half of the staff increases projected for the future, and that when the center is in full operation, potential savings could amount to as much as $2.50 per volume processed. In addition, the percentage of staff time devoted to acquisitions and processing will presumably decrease, thereby increasing the time available for direct user-related services.

From our study we also learned that the average time the libraries can now expect to receive an unprocessed order is 6 weeks. We therefore strove

- to provide libraries with quick service from the time an order is placed until the book is received, fully processed. Because the center will be highly automated, the elapsed time between order placement and receipt of a fully processed book will average 2 to 3 weeks.

Because of the ready economies involved, we also strove

- to standardize on operating procedures where such standardization is necessary for the center's operation and does not infringe upon normal library practices.

A major insistence was

- to allow each library full freedom in the selection of materials.

And finally we tried

- to provide useful services to the libraries during the various phases of implementation.

With these criteria in mind, we developed the notion of a centralized processing center. It is designed to operate under the Central Administrative Staff and to serve each library in the SUNY complex.

OUTLINE OF THE CENTER'S OPERATION

In order to achieve better service and more timely reporting each library will utilize data communication equipment to transmit orders to the processing center. Orders will be typed at each library on a keyboard console designed to produce a machine-readable punched paper tape as a byproduct of the order typing process. A central computer at the processing center will receive, process, account for and forward these orders when they are transmitted via normal communication lines.

The central computer will collect these orders and issue standard purchase orders to both vendors and publishers on a daily basis. Given the volume this center will handle, it is possible that greater discounts would be forthcoming, especially from the larger suppliers. It is important that this center establish workable relationships with major vending and publishing houses. During the course of this study we visited a number of vendors and believe such cooperation can be established. Many vendors

are currently installing data processing equipment and a possible future development might be for the center to provide machine-readable order information to such vendors. In some cases, it might be desirable for the center to deal directly with publishers rather than vendors. If so then either these major publishers need to be included in the current SUNY contract for purchasing books or the center should not be obligated to operate under that contract. In this planning study we have allowed for this possibility.

In viewing the operations of a number of vendors, we feel that the best service can be obtained by having the center pick up filled orders from the large vendors in the nearby area on a regular basis. This scheme would ensure that orders are not being held up by one or two books which the vendors have back ordered, nor would the orders be subject to the usual mail or transportation delays.

The processing center will be highly automated to provide an efficient operating environment. Two main files will be utilized by the computer at the center for keeping detailed records of all transactions. The first of these we have labeled the Authority File*. One record in this file will correspond to each unique title the processing center has handled. It will contain cataloging data necessary to produce standard catalog cards, and in addition, will record the number of copies each library has ordered of this title. The Authority File thus becomes a major tool for use as a union catalog of all material held by the SUNY libraries.

Two approaches are possible in providing access to this file. One involves the use of an identification number which must be known to gain access to a particular entry. While this method is attractive in terms of efficiency and accuracy it has some very obvious disadvantages, especially in the long-term environment. We have chosen to approach this problem directly by providing access to the file on the basis of author and title.

The primary function of the Authority File in the ordering process will be to check an order for a given book to determine if cataloging information is available. If cataloging information is not available all efforts will be made to pre-catalog the book, i.e., obtain the data necessary for cataloging before the book arrives from the vendor. If cataloging data is available, then no further action is required until the book is received at the center.

*Throughout this report, 'Authority File' designates the particular machine file described here. This machine file does not contain the same data as the various Authority Files used within libraries.

In order to begin operation of the center a fairly large Authority File is needed. Two sources are currently available for this purpose. One is the Library of Congress MARC project, the other is the special project of the Library of the University at Buffalo to produce a printed book catalog. We have investigated both projects and have found that their machine-readable outputs will be useful in constructing an initial Authority File of cataloging data.

In addition, the continued use of the Library of Congress machine-readable cataloging data will provide timely assistance in the cataloging of newly published material. This machine-readable data is available well before the standard Library of Congress catalog cards themselves.

When a book is received at the processing center, computer display equipment will be used by staff members to record the receipt of a book and to cause the computer to print catalog cards and labels necessary for processing. These cards and labels will be of a quality which fully meets standard library requirements. Processing to be performed includes:

- placing a complete catalog card set into each volume;
- placing a label on the spine of the book;
- affixing a label to a pocket and attaching the pocket to the book itself;
- affixing a label to a borrower's card and placing this card in the pocket.

In order to keep an accurate record of all transactions, a second file is needed which we call the On-Order File. This file records the status of all outstanding orders and serves as a check to insure proper shipment and accounting for each book ordered through the center. Since the center will be dealing directly with vendors and publishers, it must be responsible for receipt of books, payment of bills, and distributing charges to individual libraries for the books they have received.

We have assumed the center will be treated administratively as a department of the central administration of the University. Thus it will depend on the University for much of its financial administration and budgeting, and on the Department of Audit and Control for the major portion of its accounting. The center will use standard State procedures for paying its personnel and for purchasing its supplies and miscellaneous services. As a result, the only unique aspects of its accounting will be those related to the purchase of books and the application of electronic data processing to the system.

Because the center will be a department of the central administration, a complete accounting system as would be needed for an independent entity, is not required. We need only to discuss the unique aspects of the proposed system. In this regard the proposed system closely follows the "simplified" procedures for purchasing library books, as outlined in the State University

of New York Office Practice Manual. Furthermore, as a practical matter, the minor changes which resulted from centralization and the use of electronic data processing have been tentatively approved by the Office of General Services and the Department of Audit and Control. Informally, the Office of General Services found no objection to the operation of the facility as it will continue to operate within the current contractual framework with vendors. Similarly, the Department of Audit and Control raised no significant criticism of the proposed procedures, although their review is not at this date complete.

A major advantage of the centralized processing operation will lie in its ability to provide fast service. We believe that the best service is possible by having orders picked up by the center's staff from as many of the large vendors and publishers as is practical, thereby avoiding the delays due to mail, common carrier delivery, or vendor/publisher delivery. To accomplish this effectively requires that the processing center be located as centrally as possible with respect to the large vendors and publishers.

Our study has shown that the majority of the large vendors' and publishers' warehouses from which a large percentage of the books will originate are located in the New York Metropolitan Area (New York City, Long Island, and New Jersey). In providing quick service, it is essential that a SUNY vehicle make daily visits to publishers and vendors (not each publisher and each vendor each day, however).

We have provided for orders to be delivered to each campus once a week, with rush orders being handled by mail. Delivery will be by commercial carrier, since this represents the least costly method.

Our recommendation is that the location of the processing center be in Rockland County. Adequate and plentiful sites are available in Rockland County. The availability of a rental building at the time the system is initiated is unknown, although if the State of New York can agree to adequate leasing terms, a suitable building can be built to specifications by a contractor. This location would offer the best combination of: ease of order pickup; accessibility to the New York Thruway and Interstate Highway System; proximity to a large potential pool of part-time employees; accessibility to good services for data processing equipment; proximity to educational and cultural services for attraction of professional personnel; and availability of an adequately sized facility on a rental basis to permit early initiation of the center.

SCHEDULE FOR THE ESTABLISHMENT OF A CENTRALIZED PROCESSING CENTER

In this section, we present a summary of tasks to be performed in each phase in order to establish a centralized processing center. These tasks are described in detail in the body of this report.

Phase I - Implementation: April 1968 - July 1969

We have allocated the period April 1968* through July 1969 to be used for implementation of the center. A summary of major tasks to be performed during this period include:

- prepare and submit requests for quotations on data processing equipment, and select the manufacturer;
- prepare requests for proposals for computer programming, and select the most qualified contractor;
- select a building in which to house the center and make modifications to it as detailed in this report;
- engage key professional personnel to establish the center's detailed operating procedures;
- engage other staff to begin training in their prospective activities;
- select and order operating supplies and equipment;
- begin work on the construction of an Authority File;
- prepare a detailed budget for fiscal 1968-1969;
- arrange for communication lines to be installed;
- receive computer hardware and software, and conduct field testing using two libraries;
- begin installing terminal equipment in the libraries.

Phase II - Establishing a Service: July 1969 - April 1970

Phase II in the plan to establish a centralized processing center will involve providing limited service for the processing of books. A limited number of libraries will be able to order American in-print titles

*The starting date is, of course, arbitrary and it depends on obtaining final budget authorizations and on general preparedness.

through the center during this evolutionary period.

The center's staff in cooperation with other SUNY offices should work in this phase toward these ends:

- the development of a smooth operating system in production-line fashion;
- accurate estimation of costs to contribute to the preparation of a budget for 1970-1971;
- the investigation and implementation of new operating procedures leading to improved work flow;
- the construction of detailed plans for Phase III, including improvement in service and modifications to procedures and equipment.

Phase III - Expanding the Service April 1970 -

During Phase III the center will expand service to all SUNY libraries, and provide ordering and processing functions for other kinds of books. Specifically, the plans include:

- the use of regional message concentrators to expand the communications network to all libraries;
- the ability to order foreign and out-of-print material through the center;
- the ability to query files at the center from remote library stations;
- the development of a message switching network for inter-library communication;
- the realization of a smoothly operating centralized processing center which handles 900,000 volumes per year.

SUMMARY BUDGETS

The budget estimates summarized below are drawn from the details developed in the body of the report.

It should be noted that data processing equipment costs are contained in "Supplies and Expenses" and constitute a major cost for that category. Although this equipment will be required on a single shift basis only, the entire rental cost is included in the budgets. Accordingly, the University may wish to provide computer resources to other state agencies during other shifts. We have already alluded to other library processing activities within New York State and these might be good potential customers for the available computer time. However, other non-library applications could just as well utilize this resource. The value of the computer time available is estimated at between $100,000 and $200,000 yearly. This "income" has not been included in any of the budget estimates.

PHASE I

Staff	$ 221,640
Supplies and Expenses	124,000
Temporary Services	200,000
Equipment	79,000
TOTAL:	$ 624,640

PHASE II

Staff	$ 353,250
Supplies and Expenses	437,000
Temporary Services	40,000
TOTAL:	$ 830,250

PHASE III - (Annual Operating Budget)

Staff	$ 564,600
Supplies and Expenses	889,000
TOTAL:	$1,453,600

THE DESIGN OF A CENTRALIZED PROCESSING CENTER

PHASE I. IMPLEMENTING THE PROCESSING CENTER

INTRODUCTION

The objectives of the Phase I period are to establish the center as an entity within the framework of the State University of New York, and to complete the detailed planning regarding the center's location, its staff, its equipment and its operating procedures. In this section we present requirements for a building to house the center, and we develop a recommendation for the center's location. In addition, we describe a number of tasks which are to be completed during this phase and which are necessary before the center can offer services to libraries in the SUNY complex. Finally a budget estimate for Phase I is developed.

BUILDING REQUIREMENTS

The building to house the processing center should be a single-floor structure containing approximately 25,000 square feet of floor space. Parking facilities for 75 vehicles should be provided, in addition to a loading platform for up to 3 large trucks. Air conditioning, humidity control, and 70-foot candles of lighting should be available throughout the entire building. A sprinkler system is required.

The 25,000 square feet should include about 7,000 square feet of office space. These offices should be set aside from the main processing area. Offices should be available for a director and an assistant, a library department, a business office and a data-processing department. In addition, special facilities including a false floor and extra power capacity will be required for a computer room. We suggest a reception area and a staff lounge be provided in the building. Generally, facilities for a staff of 80, with women outnumbering men two to one, are required. A large storage area for supplies should be included.

The building layout shown in Figure 1 is intended to give a general impression of the facilities we have outlined. The floor space assigned as well as the general layout are indicative of a building well suited for the book processing activities specified in this report.

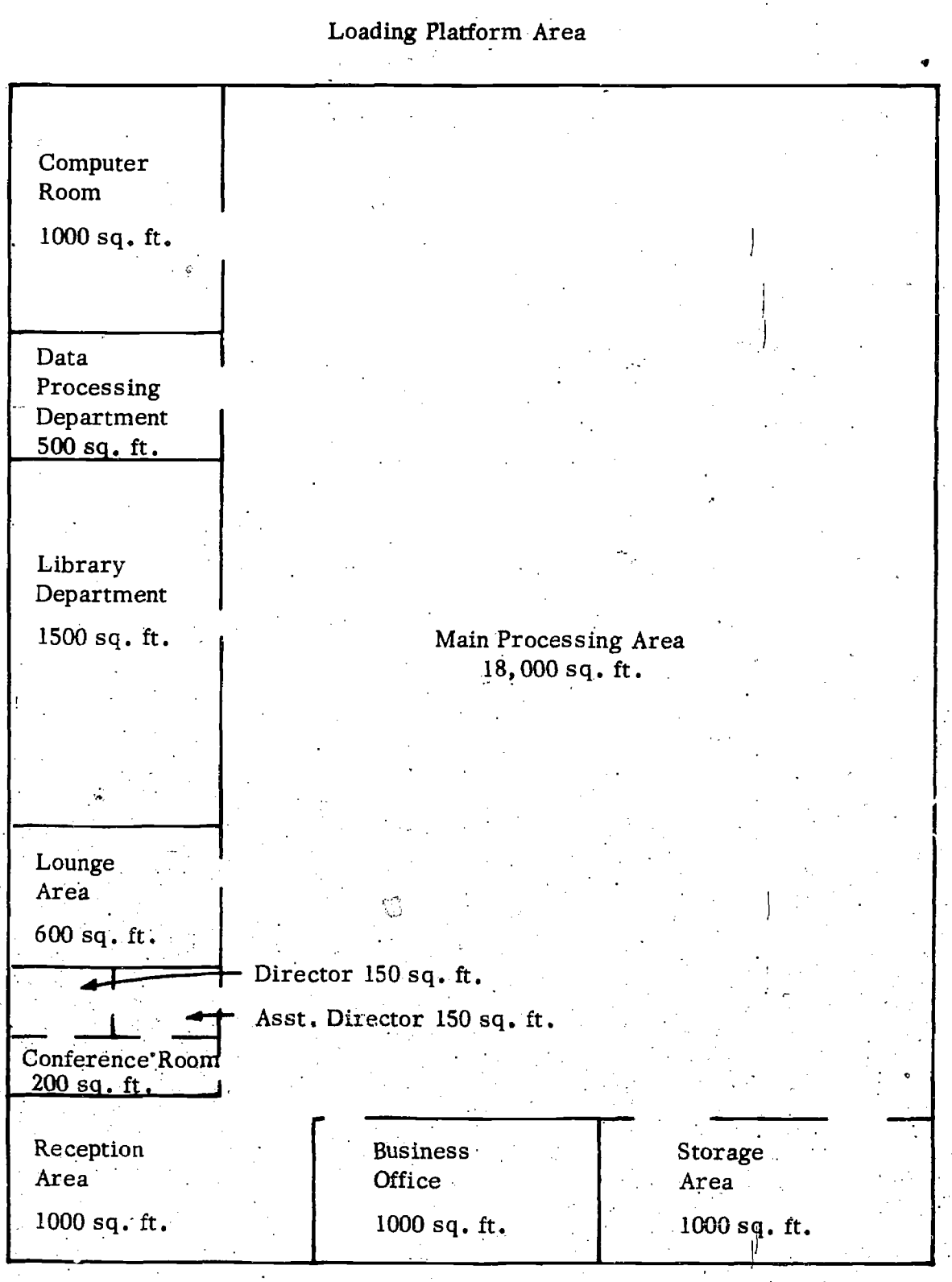

FIGURE 1 BUILDING LAYOUT FOR A CENTRALIZED PROCESSING CENTER

LOCATION OF THE CENTER

An important element of the centralized processing operation is its ability to provide fast service to the campus libraries. Our view of the center's operations and our visits to some of the larger vendors suggested that fast service would depend on the ability to pick up orders from the larger vendors' and publishers' warehouses on a frequent basis rather than relying on vendors and publishers to deliver the ordered volumes by mail, common carrier, or their own trucks. Such frequent pickup would not only minimize the time required to get a volume (and prevent orders being held up because one or two items were not in the vendor's stock) but would also help the center to regulate its throughput.

Frequency of order pickup would be a function of the number of volumes ordered and the load at the center. Flexibility in the frequency of pickup is desirable.

Another aspect of service is the ability of the center to deliver the volumes, once processed, to the various campuses. We have assumed shipment would be made once a week, with rush orders sent by mail or air parcel post to avoid any undue delay.

In selecting a location for the center, we have paid particular attention to the order pickup capability and delivery requirements. In addition, we sought to meet the following criteria:

- Proximity to the New York Thruway and the Interstate Highway System to expedite delivery by either SUNY truck or common carrier.
- Accessibility to an area where there are persons available for part-time employment.
- Accessibility to good services for data processing equipment.
- Accessibility to educational, cultural, and recreational facilities for attraction of professional personnel.

Figure 2 shows the location of those book vendors under current contract with SUNY which are near or in New York State. Also shown in this figure is the location of the warehouses of the large publishers from whom it can be anticipated that sizeable quantities of books will be ordered.

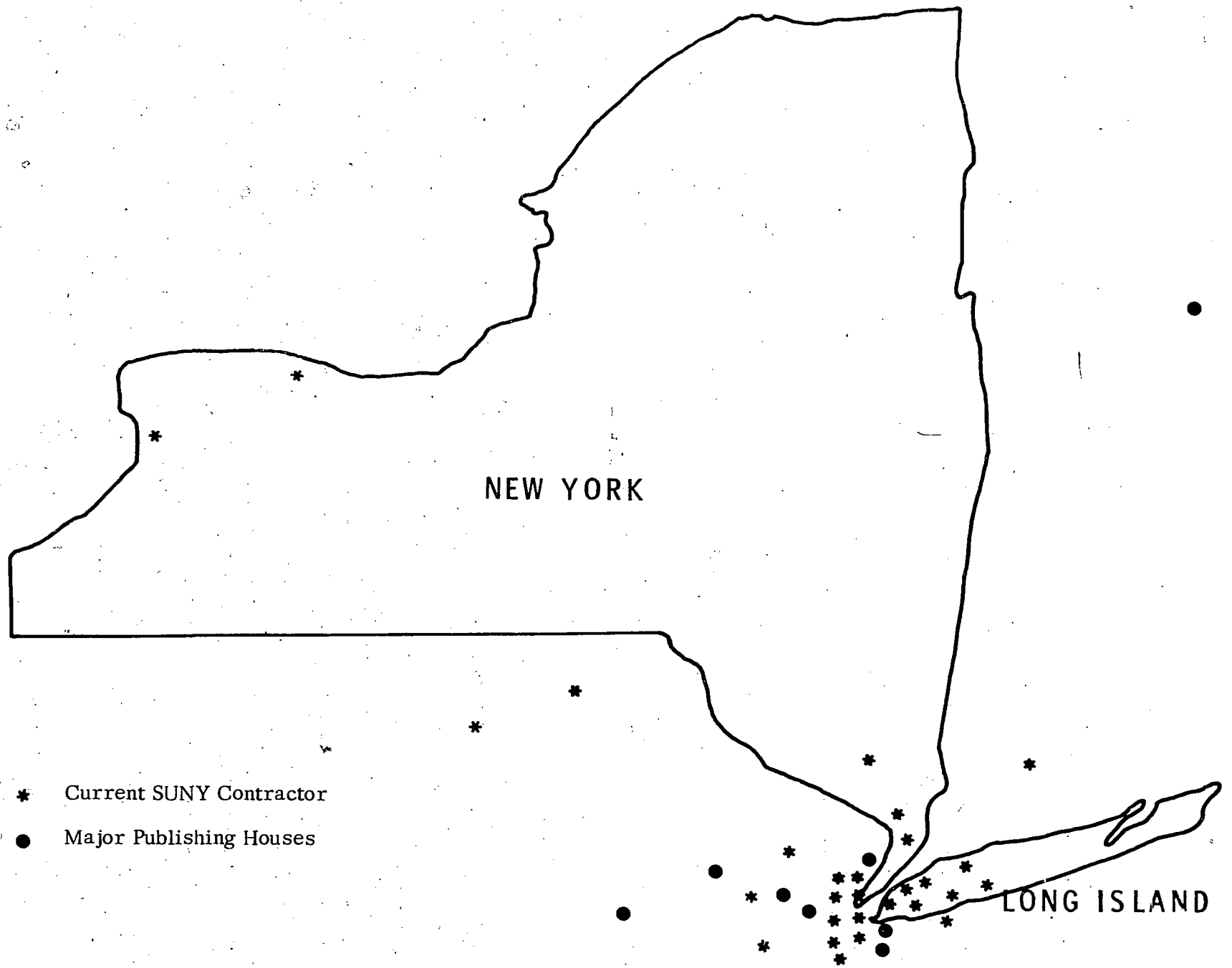

FIGURE 2 LOCATION OF BOOK SUPPLIERS

If we assume that one SUNY truck operates on a daily pickup basis, each of the warehouse locations will be visited once to three times per week. If more frequent pickup proves necessary, additional trucks can be added. Because of the need for frequent pickup, a location in the vicinity of New York City has the advantage of minimizing the travel time and the cost.

The order pickup and delivery requirements coupled with the other locational criteria listed earlier, point to a location in either Rockland or Westchester counties. A location in either county would give easy access to New York City, Long Island, and New Jersey without the need to be within congested areas. Access to the Thruway would be excellent. Both counties combine ease of urban area services with suburban amenities.

In considering a location in either county, it was important to consider the type of location and the specifications for the type of building required to house the centralized processing center. Since the processing center is scheduled to begin operations in July 1969, it was necessary, in considering the specific location for the center, that a building close to these specifications be available on a rental basis (to avoid the delays inherent in any new construction program) by the time the center was ready to begin operations.

Working through the regional office of the New York Chamber of Commerce and knowledgeable realtors identified by that office, we obtained information on and visited existing sites and currently available buildings in both Rockland and Westchester counties.

Of the two counties visited, Rockland County is the recommended location. More existing buildings are available and labor is more available.

Generally speaking, buildings which are being built-to-suit by real estate developers for specific clients in the area are renting for 10 to 20 cents less per square foot than the current existing buildings. These buildings are new and they are tailored to the user's specifications. They contain many features which SUNY would have to add to an existing building, adding to the existing rental costs. While the availability of existing buildings within the time span we are considering is constantly changing, we identified four or five existing buildings during our study which appeared suitable. Six months to a year from now there might be another four or five, there might be eight or ten, or there might be none at all. The price for existing buildings in the future will certainly be higher, perhaps considerably higher, since there are very few speculative industrial buildings being built.

Consideration should be given to the possibility of a real estate developer constructing a building specifically for the processing center; i.e., with SUNY giving a guaranteed commitment to lease the building.

This would insure a building suiting SUNY's requirements at a price which is a more realistic value. However, this would probably involve a minimum of a twenty year lease.

We present the building descriptions listed below to provide examples of the types of buildings currently available, and upon which cost estimates have been made.

Size Sq. Ft.	Location	Description
26,000	Irvington Street Pleasantville, N.Y.	New two story building, second floor available, direct tailboard loading, 16' clear height, 50 car parking, fully sprinklered, 180 lb. floor load, offered at $1.40 per sq. ft., price does not include office space or air conditioning, available immediately.
51,000 on 4 acres	Pear River Industrial Park Hunt & Blaisdell Rds. Orangetown, N.Y.	New building, 5,000 sq. ft. finished offices, 30' x 36' column spacing, 20' clear height, tailboard loading for two trucks, offered for lease at $1.10 per sq. ft., net, taxes approximately 20¢ per sq. ft.
24,000	Kings Highway Orangeburg Town of Orangetown, New York	One floor, 82' x 270' x 14' ceiling, tailboard loading, heavy floor load, fully sprinklered, approximately 40 car parking, office of approximately 1,500 sq. ft., offered for lease at $42,000 per annum or for sale at $350,000; available April 1968, or sooner. This building is located on 4.6 acres of land.
36,600	669 South 3rd Ave. Mt. Vernon, N.Y.	Former liquor warehouse. Two stories with 31,800 sq. ft. on the first floor, and 4,800 sq. ft. of offices on the second. The offices are fully air conditioned. The building is sprinklered, heated, and has water, gas, electricity, and sewer. It was built in 1958 with steel frame brick and block and is on a site of 60,000 sq. ft. It has 18' ceilings. The rental price would be about $1.50 per sq. ft.

We also identified a number of sites for a new building. In terms of general land availability, there is a great deal of building land zoned for industrial use available in both Rockland and Westchester Counties. This land is suitably located with excellent access to the New York State Thruway and the Cross Westchester Expressway. There is enough land to construct a building which satisfies requirements for the center and to have land available for future expansion. The following list of sites is representative of some of the parcels of land available but it is certainly not intended to be exhaustive. If it were to be decided that a new building should be built to SUNY's specifications, it is likely that twice as many sites could be listed without difficulty.

Size	Location	Description
3 acres	Kings Highway, Route 9W & 340 Sparkill Town of Orangetown, N.Y.	All utilities, 50% coverage, railroad siding possible, offered for sale at $25,000 per acre.
3.5 acres	East side of Route 9A No. Elmsford Town of Greenburgh, N.Y.	All utilities, 35% land coverage, two stories with direct loading to each floor possible, offered for sale at $70,000 per acre.
4 acres	East side of Route 9A No. Elmsford Town of Greenburgh, N.Y.	Former Tacoma Nursery site to be developed with two buildings, one of which shall be 26,000 sq. ft. with no expansion, available for lease, price subject to tenant's requirements.
6.88 acres	Route 303, West Nyack Clarkstown, N.Y.	All utilities, approximately 40% coverage, offered for sale at $20,000 per acre.
16 acres	Route 303 & Bradley Hill Road Orangetown, N.Y.	All utilities, 50% coverage, offered for sale subject to offers.
17 acres	Route 303 and N.Y. Thruway Entrance Blauvelt, Town of Orangetown, N.Y.	All utilities, 40% coverage, built-to-suite only by owner.
26 acres	Schoolhouse Road Town of Ramapo, N.Y.	Approximately 50% coverage, all utilities except sewer, offered for sale at $18,000 per acre.

Size	Location	Description
56 acres	Route 303 Congers, New York	All utilities, except sewer, offered for sale subject to offers, however, owner prefers to built-to-suit.
30 acres	On Route 17 Approximately 3 miles from Exit 15 of the Thruway.	Sterlington Industrial Park. Accessibility: Within easy reach of New York City and the Metropolitan District, New Jersey, Pennsylvania, and New England. 20 minutes from Westchester, 24 miles from the George Washington Bridge, and 45 minutes from the Lincoln Tunnel. Airports: 4 metropolitan airports within 1 hour--Idlewild 1-1/4 hours. Railroad: Directly on the main line of the Erie-Lackawanna. Utilities: Unlimited electric power at reasonable rates. Natural gas--at one of the lowest rates in the Northeast. City water at 120 pounds static pressure. Ramapo River water--for industrial use 30,000,000 GPD year round average flow.

Based on our study we recommend that serious consideration be given to having a building constructed to SUNY's own specifications. Not only will this reduce the annual rental cost, but it will also make operations easier and allow for expansion. A contractor will be willing to erect such a building on a lease-back basis, provided that suitable leasing terms (10 to 20 year lease) can be arranged. If only a short-term lease is possible, an existing building will have to be used at a cost and efficiency penalty. Annual rental costs will average about $35,000 - $40,000 for a building of the specifications required.

PHASE I. TASKS

We have identified a number of tasks which are to be completed during Phase I. These tasks involve final preparations for the center's operation. We have sketched the sequence of tasks and their timing in Figure 3.

As soon as possible, requests for quotations for data processing equipment should be prepared and a manufacturer selected. The specifications for data processing equipment should be based upon the data presented in Appendices D and E of this report. Once the manufacturer has been selected, a request for proposal for computer programming may be prepared and a contractor selected. Again, the program specifications are to be constructed from the detailed flow charts and program descriptions presented in the Appendices B and C.

It is quite evident that the processing center cannot begin operations without a large collection of cataloging data. Fortunately, two sources for obtaining this data in machine-readable form are available. The MARC project at the Library of Congress is currently supplying cataloging data for recently published books on magnetic tape. The MARC format for recording this data has become a standard and we recommend that the center's file be compatible with that format. While the MARC project is officially on a pilot basis, we feel the continuance and expansion of the project is likely. In addition to the Library of Congress, the library of State University at Buffalo is also producing cataloging data in machine-readable form. The output of this project is also compatible with the MARC format.

A number of tasks are required to construct an initial Authority File of cataloging data. Foremost among these is the establishment of specific file content and format. In this report we have considered content requirements for producing catalog cards only. Because the potential use of the Authority File extends beyond the requirements for producing catalog cards we recommend that further long-range study be made to determine these details, and that this study be performed by the processing center staff during Phase I.

Once the details of the Authority File content and format have been established, the remaining task will be to obtain the complete and up-to-date outputs of the Library of Congress and Buffalo projects, and to construct a single file from them. This construction will involve a good amount of computer programming and running time. While the task may be assigned to an outside organization, we recommend that the processing center staff be responsible for constructing the file with computer time provided by a SUNY institution or a service bureau.

TASKS

- Prepare Date Processing Equipment R.F.Q.
- Select Manufacturer
- Prepare Programming R.F.P.
- Select Contractor
- Select Building and Perform Necessary Alterations
- Occupy Building
- Engage Professional Staff
- Detail Operating Procedures
- Construct Authority File
- Engage Other Staff
- Receive Data Processing Equipment
- Receive Programs
- Field Testing

PERIODS

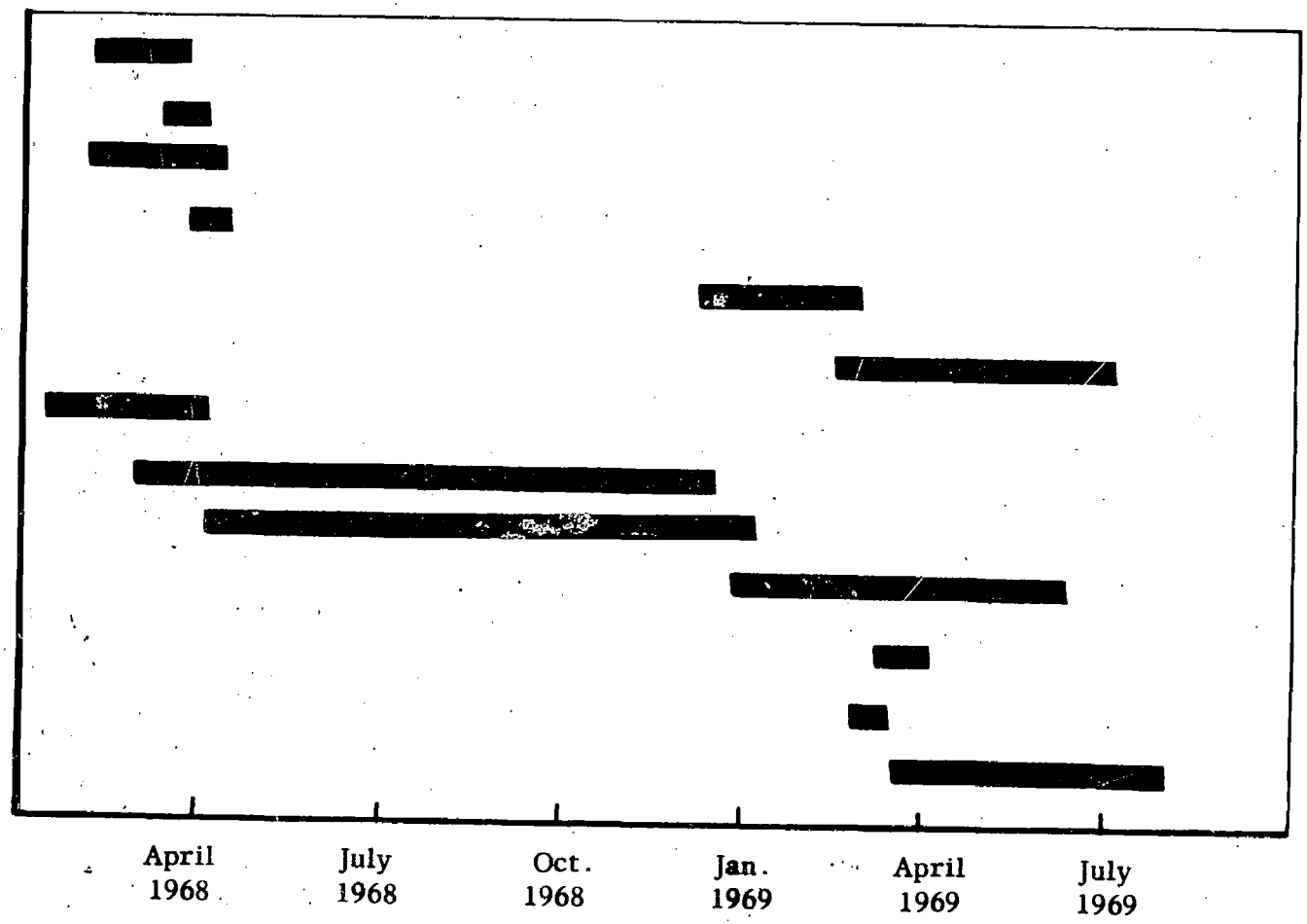

FIGURE 3 PHASE I. TIMING

During Phase I, the staff of the processing center should establish relationships with both vendors and SUNY libraries. Those vendors and publishers from whom the center will pick up books should be identified. Special discounts for volume purchases should be investigated at this time.

Upon delivery of the data processing equipment and computer programs the center may begin a field testing program. This program is intended to provide a period of initial testing and checking to determine that all components of the system are functioning properly.

We suggest that two libraries would be sufficient for participation in this program. These libraries should receive remote terminal equipment and have the necessary communications facilities installed in time for field testing.

A sizeable amount of testing data should be generated for this program. Testing should involve the flow of orders from the library to the center and subsequent machine processing.

Only when the programming and equipment have been shown to meet the required specifications should the installation of terminals and communications facilities be initiated for other libraries.

A document describing the use of the remote terminal and the center's operating procedures should be developed and made available to participating libraries.

The key personnel of the center should be working on details of operating procedures throughout the Phase I period. These details include specifications for the building, selection of processing equipment and supplies, and layout of the necessary forms.

We believe the periods indicated in Figure 3 are reasonable estimates for the tasks to be completed.

STAFF

The professional staff needed to begin most of the Phase I tasks should be engaged as soon as possible. It is extremely important that these people be involved in decisions to be made in the early part of Phase I. The staff requirements for these tasks are:

- Director
- Assistant Director
- Business Manager
- Chief Librarian
- Data Processing Manager
- Two computer programmers

Near the completion of this phase, but before field testing is begun, they should begin to engage other staff for their respective departments. Most of this staff should be available for training during the field testing period, and for completing final preparations for Phase II.

When the building is ready for occupation an administrative assistant in charge of miscellaneous services such as shipping, order pick up, printing operations and maintenance will be required. We feel the center should have its own facilities for printing forms, notices, and reports. The staffing of this department at this time should include a maintenance man, and a senior driver, with a senior shipping clerk, personnel clerk, switchboard operator and offset machine operator engaged before the end of Phase I.

The library department should add a senior cataloger and 2 senior library clerks to complete work on the Authority File construction and on detailed operating procedures. In addition, 4 senior clerks should be available for computer display console operations during the field test period. Before the completion of Phase I, the library department should be at full strength for Phase II. Personnel required include 2 catalogers, and 3 library clerks to perform cataloging and maintenance of the Authority File, and for special ordering functions.

The business office will require a senior clerk during the final period of Phase I to establish in-house business arrangements.

The data processing department should be well staffed before the field test period. An assistant manager, two computer operators, 2 keypunch operators and 4 assistants will be required. Since the computing equipment will be located in several places throughout the building, the assistants are necessary for operating and servicing of the decentralized equipment.

A processing manager and two senior clerks will have responsibility for selection and ordering of processing supplies and equipment. These clerks will be in charge of the actual processing operation.

An organization chart of the processing center is shown in Figure 4.

BUDGET FOR PHASE I

In this section we present an estimated budget for the Phase I period April 1968 through July 1969.

STAFF

The first phase staff requirements were outlined in the previous section.

Administration

Director	for	15	months	at	18,000	per annum	$ 22,500
Asst. Director	"	"	"	"	16,000	" "	20,000
Secretary	"	"	"	"	5,000	" "	6,250
Secretary	"	4	"	"	5,000	" "	1,700

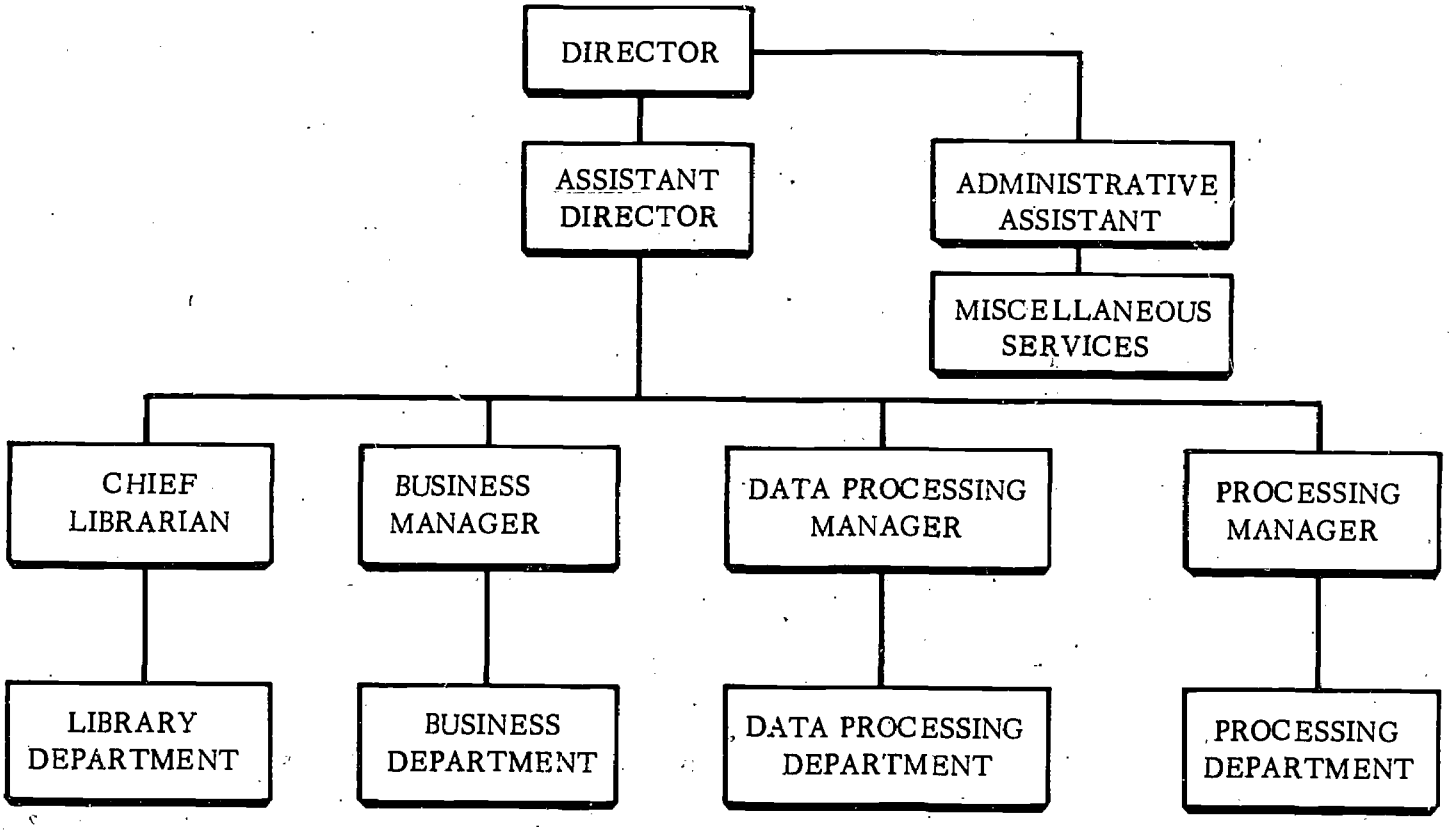

FIGURE 4 ORGANIZATION CHART

Miscellaneous Services

Admin. Asst.	for	4	months	at	10,000	per	annum	$3,400
Maintenance Man	"	"	"	"	7,500	"	"	2,500
Senior Driver	"	"	"	"	6,500	"	"	2,150
Sr. Shipping Clerk	"	2	"	"	6,500	"	"	1,100
Offset Machine Operator	"	"	"	"	5,000	"	"	850
Personnel Clerk	"	"	"	"	5,000	"	"	850
Switchboard Operator	"	"	"	"	4,000	"	"	700

Library Department

Chief Librarian	for	15	months	at	14,000	per	annum	17,500
Senior Cataloger	"	4	"	"	12,000	"	"	4,000
(2) Senior Library Clerks	"	"	"	"	5,000	"	"	3,400
(2) Catalogers	"	2	"	"	9,000	"	"	3,000
(3) Senior Library Clerks	"	"	"	"	5,000	"	"	2,500
(4) Senior Clerks	"	"	"	"	5,000	"	"	3,400
(4) Clerk/Typists	"	"	"	"	4,000	"	"	2,700

Business Department

Business Manager	for	15	months	at	14,000	per	annum	17,500
Secretary	"	"	"	"	5,000	"	"	6,250
Senior Clerk	"	4	"	"	5,000	"	"	1,750
Clerk Typist	"	2	"	"	4,000	"	"	700

Data Processing Department

Data Processing Manager	for	15	months	at	14,000	per	annum	17,500
(2) Computer Programmers	"	"	"	"	10,000	"	"	25,000
Secretary	"	4	"	"	5,000	"	"	1,700
Asst. Manager	"	"	"	"	12,000	"	"	4,000
(2) Computer Operators	"	2	"	"	9,000	"	"	3,000
(4) Assistants	"	"	"	"	5,000	"	"	1,700
(2) Keypunch Operators	"	"	"	"	4,000	"	"	1,400

Processing Department

Processing Manager	for	4	months	at	14,000	per	annum	4,000
(2) Senior Clerks	"	2	"	"	5,000	"	"	1,700

SUBTOTAL:	$ 184,700
PLUS 20% FRINGE BENEFITS	36,940
	$ 221,640

EQUIPMENT

Capital expenditures for equipment must be made during Phase I. We have specified the type and number of pieces of such equipment, and where appropriate have indicated a manufacturer. The equipment of a listed manufacturer is not to be construed as a recommendation for this particular piece of equipment; rather we present it here so that the type of equipment is more precisely identified and for cost estimation purposes.

Desks

(9) Administrative	at 300 each	2,700
(26) Secretarial	" 150 "	3,900

Tables

(15) 30" x 60"	at 100 each	1,500
(6) 30" x 72"	" 125 "	750

Chairs

(9) Administrative	at 175 each	1,625
(30) Secretarial	" 75 "	2,250
(11) Junior Administrative	" 125 "	1,400
(25) Straight back	" 75 "	1,875
(10) Stools	" 50 "	500

Shelving

(100) sections of 7' x 4' double-faced shelves	at 40 each	4,000

Files

(20) Five drawer legal size	at 150 each	3,000
6 Upright punched card files		1,000

Typewriters

(3) IBM proportional spacing	at 750 each	2,250
(3) IBM Selectric	" 400 "	1,200
(4) IBM Standard	" 400 "	1,600

Furniture

Staff Lounge	5,000
Lockers	5,000

SUPPLIES AND EXPENSES

Both office supplies and processing supplies are to be purchased during Phase I. Past experience has shown that processing supplies cost from twenty to twenty-five cents per volume, and we have budgeted an initial stock for processing 100,000 volumes. Catalog cards, labels, pockets, borrowers' cards, and other supplies necessary for processing are included in this estimate.

Expenses for utilities, postage, and insurance are estimated. Travel costs are included for visits by the center personnel to vendors and libraries. Other services such as for special maintenance and repair work are necessary.

In addition we have included expenses for data processing equipment for 1 month during the field test period. These figures are developed in detail in Appendix D.

Bibliographic tools should include the Library of Congress National Union Catalog and selected foreign and trade bibliographies.

The building rental estimate is based on current costs for suitable structures which we have identified.

Insurance	$ 5,000
Processing Supplies	25,000
Office Supplies	7,500
Utilities	3,000
Postage	3,000
Services	3,000
Travel	7,500
Data Processing Equipment	30,000
Bibliographic Tools	15,000
Building Rental	25,000
	$ 124,000

TEMPORARY SERVICES

The computer programming which is required will have to be provided by an outside organization, and the cost for this service is budgeted for in Phase I. Our estimate of the cost for this service is explained in Appendix C. In addition, computer rental on a service bureau basis is required in conjunction with the project to construct the Authority File.

We have included in our cost estimates an amount for consulting services. We believe that many of the tasks defined in Phase I will require the use of these services, and to the extent that staff does not become available that additional funds be allocated for consulting services to insure the completion of these tasks.

Computer Programming	$ 160,000
Computer Rental (Service Bureau)	15,000
Consulting Services	25,000
TOTAL:	$ 200,000

Miscellaneous

AB Dick Offset Machine Automatic shutoff and blanket wash	$ 6,500
Ektalith or Itek Master Processor	3,000
Champion Electric Cutter	2,000
(2) Standard Register Fimafold Cutters Model #25	10,000
(4) Adding Machines	1,500
Paper collator	400
Electric stapler	200
(2) Weighing scales	400
(3) Potdevin pasting machines	900
(10) Brodart 7' book trucks	900
Switchboard	3,000
Econoline truck with double leaf springs	3,000
(4) hand trucks	200
Conveyor system	3,000
Office equipment (wastebaskets, staplers, fire extinguishers, coat racks)	5,000
TOTAL:	$ 79,550

SUMMARY BUDGET

For the 15-month period of Phase I we estimate the following budget will be required:

Staff	$ 221,640
Supplies and Expenses	124,000
Temporary Services	200,000
Equipment	79,000
TOTAL:	$ 624,640

This expense represents a capital investment in the development of a processing center.

While in Phase I no processing is to be done, its completion marks the beginning of Phase II at which time the center will begin to offer service.

PHASE II. ESTABLISHING A SERVICE

INTRODUCTION

Phase II in the plan to establish a centralized processing center is designed to accomplish two major objectives. First, it will provide an actual operating environment in which to test all procedures, both automatic and manual. This will permit changes and modifications to the system which only become evident when such an environment is present. A second objective of the Phase II operation is to provide useful service to the participating libraries on a real, continuing basis.

Both objectives require that a significant number of libraries participate, partly to assure an adequate load for testing and modifying the system, and partly to maximize the benefits of the services derived. However, the load should not be so great that a smooth, production type operation is required to cope with it. The Phase II system will have many of the basic operating features of the ultimate system.

The 25 libraries listed in Figure 1 are those we have used for planning Phase II requirements. We chose these libraries because they represent a reasonable cross-section of types of schools in the SUNY complex, and are all expected ultimately to participate in the centralized ordering program. Our estimates of the number of volumes which these libraries would order through the center provide a total figure which we regard as reasonable for system evaluation during the Phase II operation.

The second objective of Phase II operation is to provide services which meet current needs of the participating libraries. We have planned on providing participating libraries with the capability to order current American titles through the center. This will meet a real need since over 50% of the volumes now being ordered fall into this category. Because the procedure for processing current American titles will form the basis of the operating system, other services, such as the ordering of foreign titles and periodicals, are straightforward modifications of this basic scheme. By restricting its initial services to the handling of American titles, the center can concentrate on establishing a structure in which to operate, in establishing relationships with libraries and vendors, and in smoothing out its internal operation.

Our design in Phase II has included as many of the ultimate features as possible, so as to preclude radical operating changes during the system's evolution, both in the libraries and in the center. Thus, where practical, basic modes of operation and equipment configurations have been incorporated in this phase. For this reason, much of the equipment is capable of handling far more volumes than are anticipated in Phase II. This is a natural consequence of the planned phasing to full service, and we have judged the temporary excess of capacity to be preferable to repeated equipment changes.

PHASE II. PLANNING LIBRARIES

Libraries	Volumes Per Year*	Orders Per Day	Daily Transmission Time in minutes
University at Albany	30,000	120	40
University at Binghamton	30,000	120	40
University at Buffalo	30,000	120	40
University at Stony Brook	30,000	120	40
College at New Paltz	28,000	112	38
College at Oneonta	23,000	92	31
College at Potsdam	20,000	80	28
College at Plattsburgh	20,000	80	28
College at Brockport	14,000	56	19
College at Buffalo	10,000	40	14
College at Farmingdale	10,000	40	14
College at Cortland	10,000	40	14
Suffolk Community	9,200	33	11
Nassau Community	7,800	32	11
Onondaga Community	7,300	30	10
College at Canton	7,000	28	10
Jefferson Community	6,000	24	8
Corning Community	5,000	20	7
Monroe Community	4,900	20	7
College at Cobleskill	4,800	20	7
Erie Technical	3,000	12	4
College at Delhi	3,000	12	4
College at Morrisville	2,800	11	4
Fulton-Montgomery Community	2,400	10	4
College of Forestry	1,900	8	3
TOTALS	320,100	1,280	

*Estimated number of volumes ordered through the processing center for 1969-70

FIGURE 1

In the following sections we present a detailed description of the functioning of the centralized processing center in Phase II.

REMOTE ORDER TRANSMISSION

Remote automatic order transmission from individual libraries to the center is a basic element of the Phase II plan. The benefits of this mode derive from the capturing of ordering data in machine-readable form at the time of initial preparation, and this method allows normal order typing by the libraries in much the same way as they do now. Automatic order transmission will also provide quicker reception of the order by the center than other conventional methods. Ultimately, the capacity to query files at the center can be implemented with minor modifications to the scheme presented here.

The libraries shown in Figure 1 serve as Phase II planning participants and their order volume for current American titles provide planning figures for determining processing requirements.*

Each library is to be equipped with a remote console consisting of teleprinter with a keyboard and a paper tape punch and reader. The equipment will operate at a transmission rate of either 10 or 15 characters per second, depending on the type of equipment selected, and will accommodate both upper and lower case character sets.

Order typing using either all upper case letters or both upper and lower case letters can be accommodated at the center. However, since the ordering processing requires only upper case, the computer would convert the characters when both upper and lower case were used.

Orders are to be typed on a special order form, sprocket-fed, on the console. During this process a punched paper tape will be generated in an off-line mode. A form like the one shown in Figure 2 will be used for order typing. This form will be so constructed that fields of data within an order can be identified by line count.

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*The amounts shown in Figure 1 were in some cases estimates provided by the libraries themselves, in other cases they are our estimates. All figures are for 1969-1970. Orders per day and daily transmission times were estimated on the basis of 250 days per year and do not reflect any peak factor for seasonality in orders. While such a seasonality is expected, we believe it is not severe enough to significantly affect the order transmission rates we have assumed.

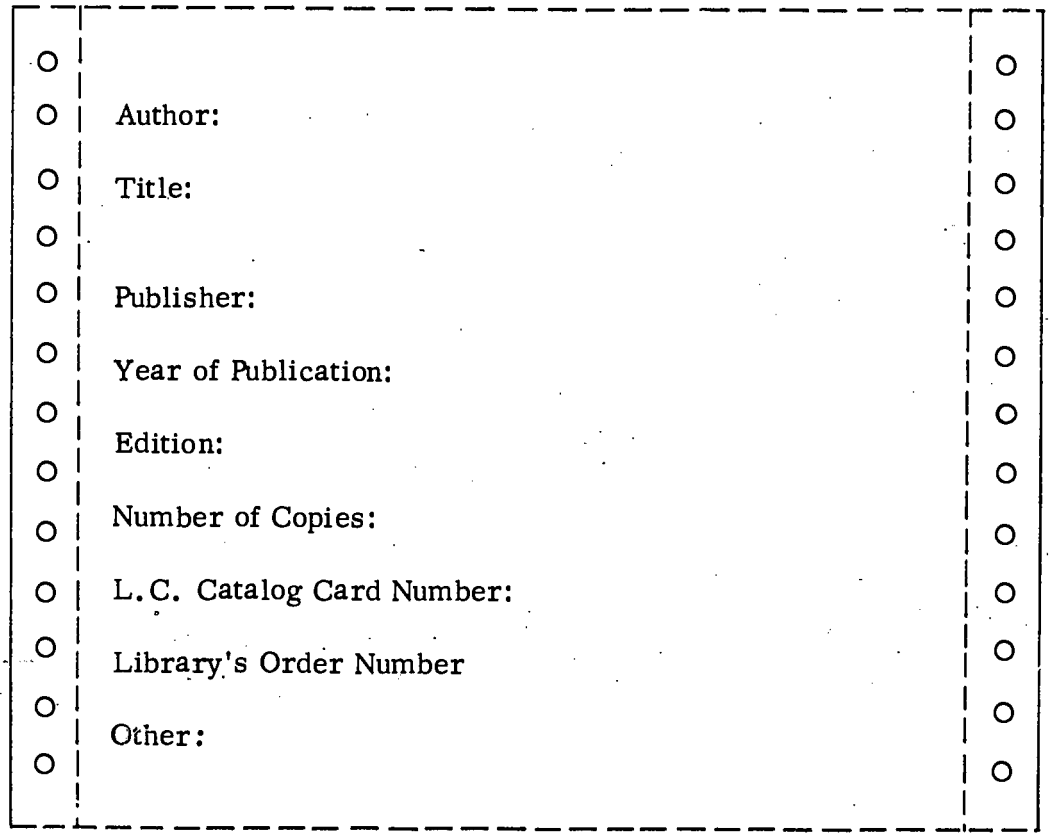


FIGURE 2 ORDER FORM FOR USE WITH REMOTE CONSOLE

The primary author is to appear first on line 1. The catalog card number is optional and will help the center to identify the desired title if it is supplied. "Other" might include specifications for a particular binding or that a paperbound volume is desired. The library's order number will be carried with the order and will appear on notices to the library from the center.

The punched paper tape will be used to transmit orders to the center. Each library will identify itself using a two-letter mnemonic code. Upon completion of the reading process, the computer will report the total number of orders received. This elementary means of acknowledging receipt of orders is believed adequate for verification of the transmission.

It is estimated that a maximum of 200 characters will be required for an item order. In Phase II a number of libraries will share a leased voice grade communication line. Only one library will be able to utilize the line at one time.

A statewide network configuration of 4 such trunk lines (with daily transmission times for each line) is shown in Figure 3. This particular configuration was designed to minimize the mileage of transmission lines while evenly distributing the number of messages over all lines. Final details of the Phase II communications network must await more definite information on which libraries are to participate. These details should be worked out with the Division of Communications, Office of General Services, so that the network takes full advantage of the available GSA-telpak and OGS Group channel mileage charges.

While only one library may transmit on a line at one time (in this phase), the data on expected transmission volumes show that four transmission lines are more than adequate. Each library will be polled at given times during each day by the central computer. This scheme will allow coordination among libraries which share a transmission line, so that contention for the line does not present problems. Schedules will have to be worked out and modified as libraries enter the Phase II operation, a responsibility which the system implementors can readily negotiate with the participants.

ORDER PROCESSING

At the center, multiplexing equipment will be required to service the four communication lines. During Phase II, libraries will be polled in the late afternoon with the incoming orders queued on a random access disc. This queue will be processed during the morning of the next working day. Order messages are checked as they are received and the library identification code appended to each.

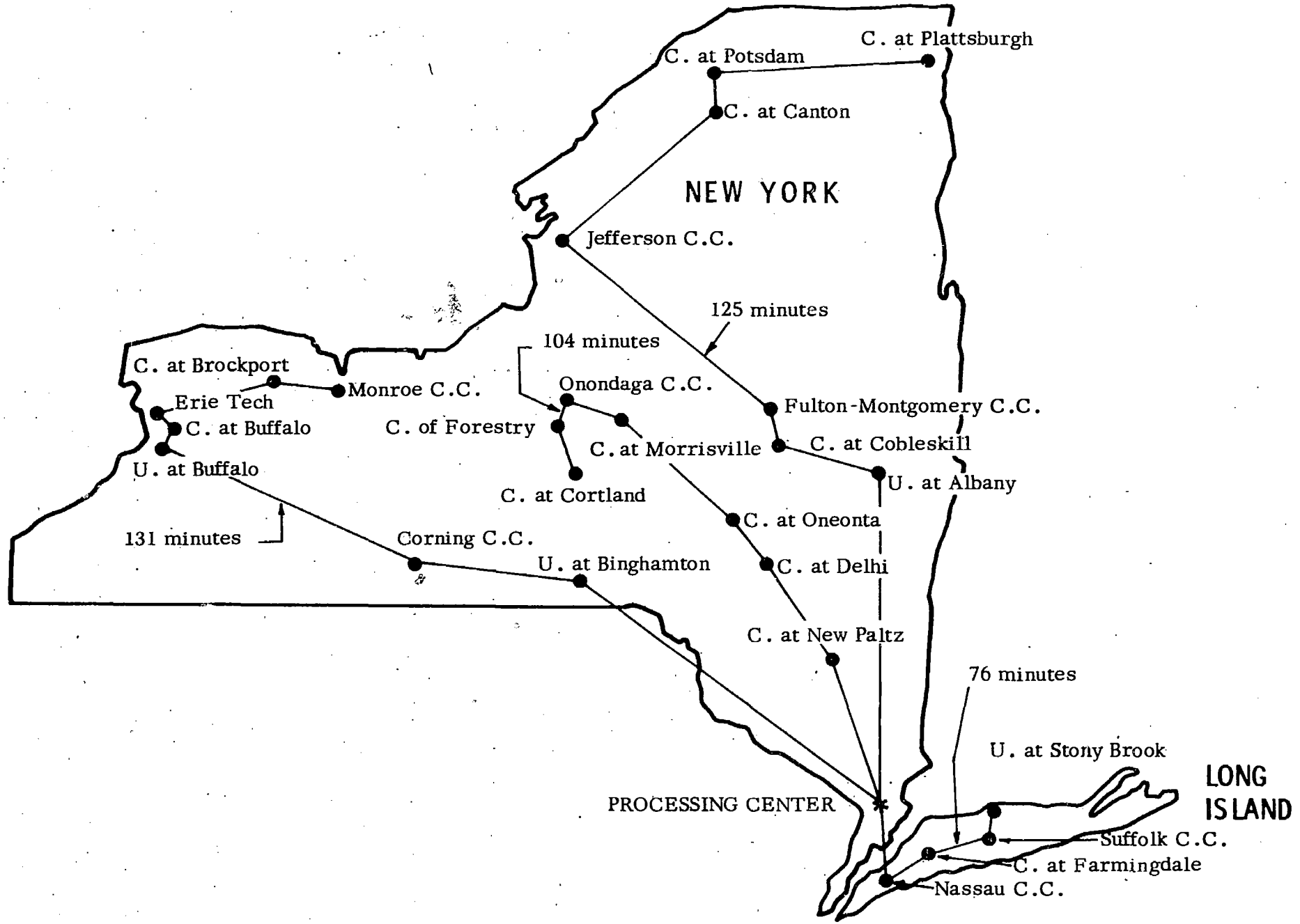


FIGURE 3 COMMUNICATIONS NETWORK FOR PHASE II LIBRARIES

A flow diagram of the order processing cycle is shown in Figure 4. The order processing, as well as other data processing operations, have been examined in detail. Figure 4 and others like it are drawn from the more detailed material presented in Appendix C.

During the morning, the order processing cycle is initiated. Orders are taken one at a time from the order queue. All orders which can be processed automatically are completed, those which require human intervention are stored on an exception queue for further processing.

When the order is read from this file it will be formatted according to the line numbers on the form in Figure 2. Because each volume ordered can be handled differently it will be necessary to have each order record correspond to a single volume. Thus, if the order calls for 2 copies, then 2 orders for 1 copy each must be created.

As a first step in the processing of an order the vendor-assignment algorithm is called. This algorithm consists mainly of a table which indicates for certain main publishers, the vendor chosen by the center's management. The algorithm must be flexible enough to implement any vendor selection scheme which the center management wishes to use. The rules for vendor selection may include the division of certain orders among a number of vendors. We expect that about 300 publishers will be assigned according to these rules. The table will be resident in core storage, and might be as shown in Figure 5.

A publisher code is constructed from the publisher's name given on the order. This code would consist of significant characters from each word in the publisher's name, and be about 6 characters in length. The code is matched against the publisher codes listed in the first column of the table. The corresponding vendor is chosen and a record of the number of orders processed by this rule is tallied. Thus, publisher "a" would be assigned vendor "Q". For publisher "c" the orders are to be divided between vendor "Q" and vendor "S". Multiple copy orders for one library would not be split between vendors. In some cases the publisher is a vendor, as with publisher "h". If the publisher code passes through the entire list without a match, the complete order is stored on the exception queue, for later manual processing. Once a vendor has been chosen, the vendor-date number is assigned, consisting of today's date and the vendor number. The number 131110367, for example, means the order was assigned to vendor number 131 on November 3, 1967.

The next step in the ordering cycle is to determine whether the item ordered has been cataloged. This is accomplished by an access to the Authority File, using the author and title as an access key. We have done some testing of an access key which uses the first 3 characters of the author's last name and the first character of the first four words in the title. If the title contains less than 4 words, the remaining letters are obtained from the last word. For example, we have the following author/title keys:

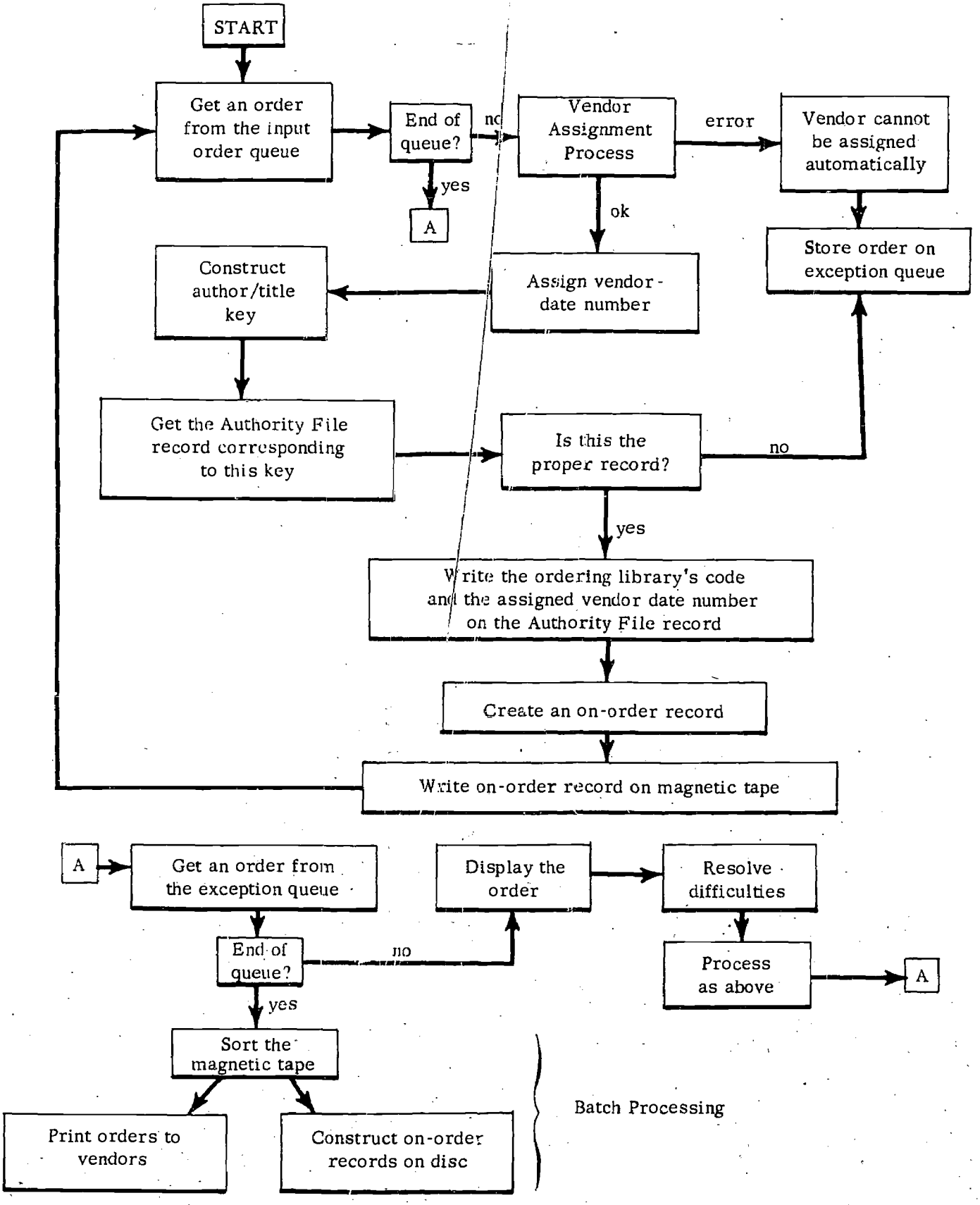


FIGURE 4 ORDER PROCESSING CYCLE

Publisher Code	Vendor	No. Orders Today
a	Q	123
b	R	004
c	1/2 Q	027
	1/2 S	026
d	T	072
e	1/2 T	050
	1/4 R	025
	1/4 X	024
h	h	312
–	–	–
–	–	–
–	–	–

FIGURE 5 VENDOR ASSIGNMENT TABLE

Gibbon, The Decline and Fall....	=	GIBTDAF
Jones, Selected Poems	=	JONSPOE
Scott, Ivanhoe	=	SCOIVAN

This scheme provided unique codes for about 98% of a sample of 200,000 titles. In those cases where duplicate access keys are developed, a note in the first Authority File record can be used to reference the other records.

While the Authority File record is of variable size, we estimate it will average about 500 characters. A typical record will contain the following items:

1. Author/title key
2. Author(s)
3. Title
4. Publisher
5. Date
6. Edition
7. Library of Congress catalog card number.
8. Other variable field cataloging data as given in the Library of Congress MARC format
9. Which libraries have this title, and the number of copies they have.
10. Which libraries have this title on-order and the vendor-date number for each order.
11. Whether the item has not been cataloged, i.e., if this is a temporary record.

Items 1-8 will be tagged according to the MARC format.

Once a record has been accessed using this scheme, other data such as L.C. card number or publisher may be used to determine a match. Also the utilization of other authors on the order may provide additional access keys. Based on appropriate experimentation with an actual file an algorithm can be developed which determines to the required reliability if the item on order and the Authority File record do, in fact, refer to

the same book. If a match does not result from any automatic search procedure, the entire order record is stored on the exception queue.

When a match has occurred the assigned vendor-date number and the ordering library's code are appended to the Authority File which is then re-written on the file. For these orders an on-order record is now constructed. This record will contain the data shown in Figure 6 and will be written on a magnetic tape file. We recommend the data in this record be in fixed-field format, with the lengths of the fields indicated in Figure 6. Once this file has been completed for all orders which were handled automatically, exception processing may begin.

Orders are taken from the exception queue and displayed at an order processing console. This console should be associated with the library department. Operators of this console should have some training in bibliographic format and be familiar with general library practices.

If no vendor was assigned, it may have been because the publisher was misspelled on the order and a correction will allow further processing. Two other options are open -- either manually choose a vendor or assign what is, in effect, an in-house vendor. The in-house vendor will be part of the library department and will receive orders in the same manner as other vendors. Personnel in the library department will then manually issue purchase orders to the proper sources for the required items. This procedure will be used for exceptions which require special attention, or for sources which are very rarely used. Some sources such as the U.S. Government Printing Office will be utilized enough to permit automatic assignment. However, publications of other government agencies, state and local governments, societies and associations, and private publishers will require special ordering. These publications form an important part of a library's collection, especially in the larger universities and specialized schools.

If no Authority File record was located automatically then it is up to the console operator to determine to his satisfaction that a record for the title in question is not in the file. He may edit the ordering data as he sees fit and attempt to locate the item. If the item is ascertained as not being in the file, a temporary Authority File record is created with the data available from the order. A hard copy output is obtained with all order data and the key address of the newly created record. This output constitutes a request to pre-catalog this item.

Two other possibilities are included in the exception processing operation. One is to temporarily hold the record in the computer, obtain hard copy output of the order, and to continue processing other exceptions. This mode will allow a number of people to be concurrently resolving problems associated with exception processing. Another capability will be to obtain a printout of the order and erase it within the computer. The order can then be returned to the originating library for clarification purposes.

Once the exception order has been cleared, an on-order record is constructed as with those orders which were automatically processed.

Entry	Number of Characters
Author(s)	30
Title	50
Publisher	12
Date	2
Edition	8
Vendor-date Number	9
Library's Order No.	10
Library's Code	2
Authority File Key	7
Other	10
Date Received	6
Price	4
Date Shipped	6
Claim Date	6
Pre-Cataloged?	1
Control Number	3
Charged?	1
	167

FIGURE 6 ON-ORDER RECORD

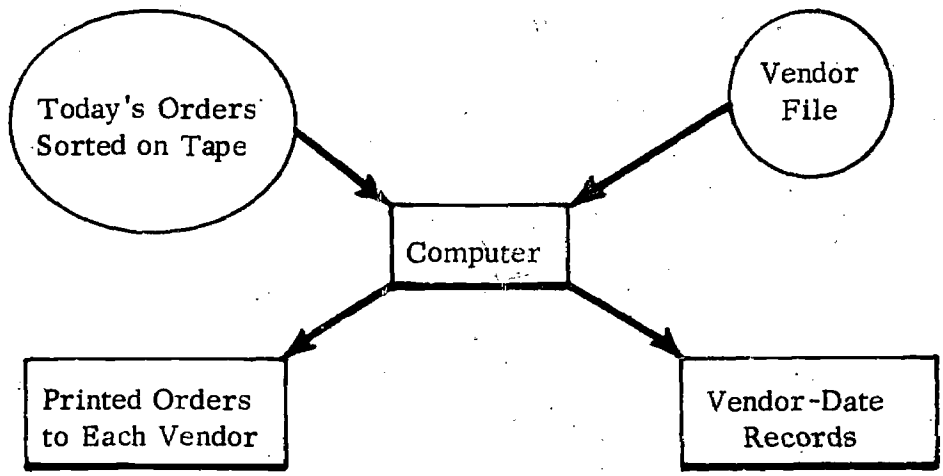


FIGURE 7 ORDER PRINTING RUN

Upon completion of exception order processing, the magnetic tape containing the on-order records is sorted by vendor code number, within vendor code number alphabetically by publisher, and within publisher by author. In a batch processing mode, the order printing run is now used to print actual orders to vendors. A second magnetic tape is required for this function which contains the names and addresses of all vendors, sorted in vendor number sequence. Also on this tape is an indication whether this vendor is actually a publisher or not. This run is shown in Figure 7 and two outputs are produced. One output is a standard multicopy order form. This order form will be printed instructing the vendor to supply the vendor date number (i.e., the center's order number) on any invoice or packing slip of items in response to this order. Concurrently, the entire vendor-date order, with vendor-date number as key, is written on a random access file. This record consists of all orders sent under this particular vendor-date number. It contains for each item the data shown in Figure 6, except that the vendor-date number is not repeated for each item, but appears in a header only.

Corresponding to a single vendor-date number, then, we could have one or a number of item records. The entire record consisting of the vendor-date number and these item records will be called a vendor-date record. An individual item record for a single title within a vendor-date record will be called an item on-order record.

CATALOGING

Original cataloging will be done only when necessary and the Cataloging Department will have all aids necessary to use existing cataloging. We have been told that L.C. format and rules will govern cataloging practices. Once a request to pre-catalog has been received, all efforts will be made to locate cataloging data before the book is received.

Three types of inputs will be processed in the catalog update run as shown in Figure 8. The first of these is cataloging data for books which have been pre-cataloged. Keypunching will be done from cataloging worksheets to update the existing temporary Authority File record.

A control card which precedes the cards with the actual data will contain the location of this temporary Authority File record, and an indication that pre-cataloging data is to follow. The Authority File record in this location is read into memory. The cataloging data is read and a new access key is constructed. This new key may in fact differ from the key to the temporary record since the cataloging process may have discovered bibliographic errors in the order information. If such is the case the temporary record must be erased and the new cataloging data written onto the file under the proper access key. Also, all item on-order records corresponding to any vendor-date numbers on the Authority File record must be accessed and the new location of the Authority File record noted. If the key for the temporary record and the key based on

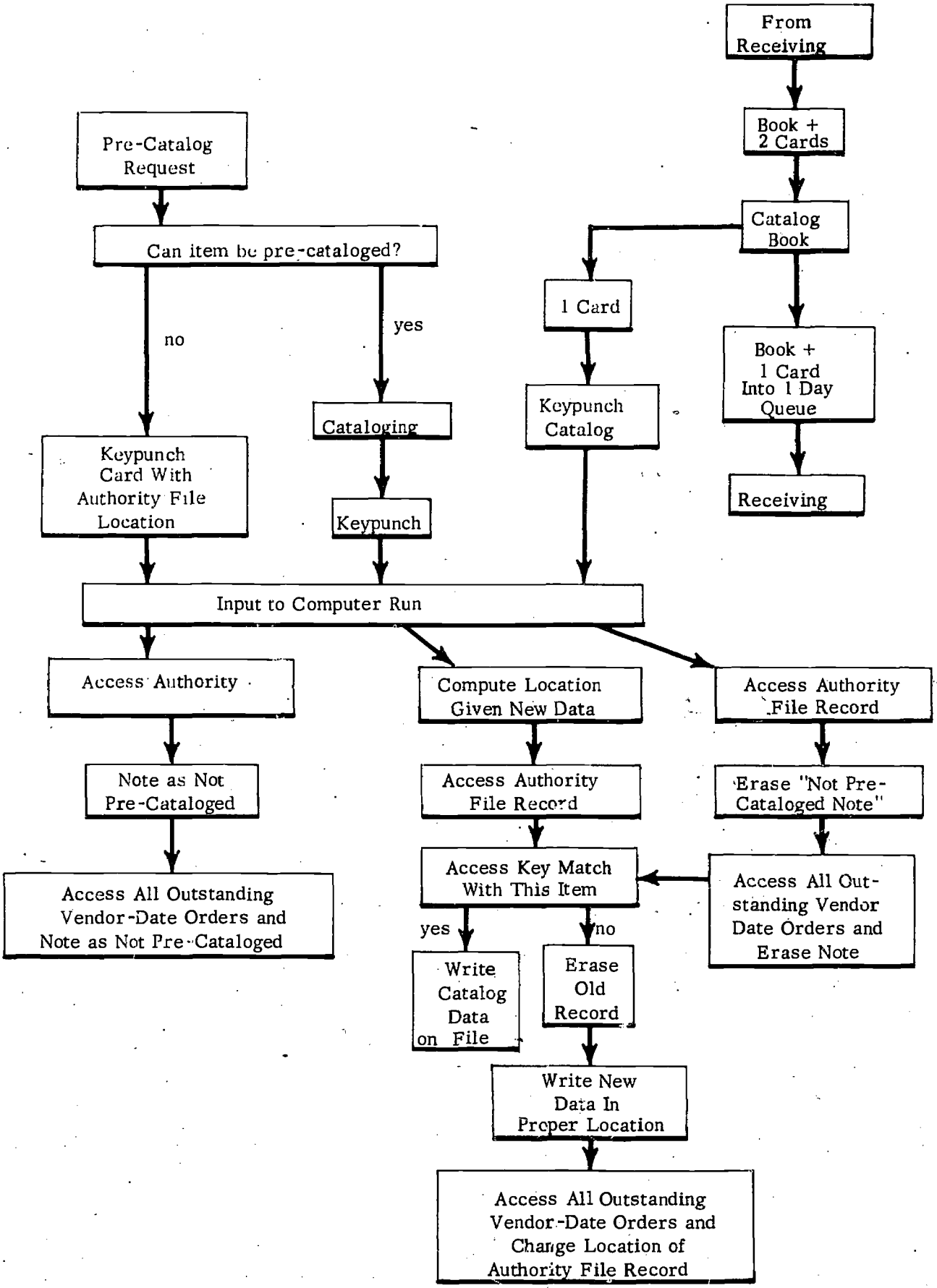


FIGURE 8 CATALOG UPDATE RUN

the new cataloging data match, then the data is added to the record, the record written back onto the file, and the temporary record becomes a permanent Authority File entry.

In those cases where it is impossible to pre-catalog, a special routine is needed. As a second type of input to the Authority File update run, a control card is punched with the location of the temporary Authority File record and an indication that the item cannot be pre-cataloged. The temporary record is read and the fact that the item has not been pre-cataloged is noted. All item on-order records corresponding to any vendor-date numbers on the temporary Authority File record must be accessed and the "not pre-cataloged" indicator is checked.

The third type of input to the catalog update results when a book which has not been pre-cataloged is received. Here, the Catalog Department will get the book plus two control cards from the receiving station. After the book has been cataloged it must await the update run before returning to the receiving station. One of the control cards followed by the cards containing the cataloging data forms the third type of input. This case follows the same steps as for the first type of input, except that all references to this item as being "not pre-cataloged" must be erased.

RECEIVING

Boxes of books will be received daily from vendors at the processing center. It is a major concern at this point to identify the items received, and all efforts should be made to encourage vendors to return invoices or packing slips with shipments, listing the vendor-date number. It is assumed that a large percentage of the volume will be so identifiable. However, the present scheme does allow identification for those exceptions where no invoice or packing slip is available. Books may therefore be processed and delivered to the libraries without delay.

A number of receiving consoles will be located near the receiving platform. One shipment from a vendor will be handled at a time. The functions which take place are outlined in Figure 9.

If neither a packing slip nor an invoice is available, the following scheme will be used to determine the proper vendor-date number. The author/title key of one book will be entered and the corresponding Authority File record displayed. In this record will be one or more vendor-date numbers for libraries currently having this title on-order. If only one such number is present then it is assumed as the proper vendor-date for this book.

If the vendor who sent this book is known (say from the shipping label) then at least part of the number is determined. Thus when more than one vendor-date number is listed in the Authority File record

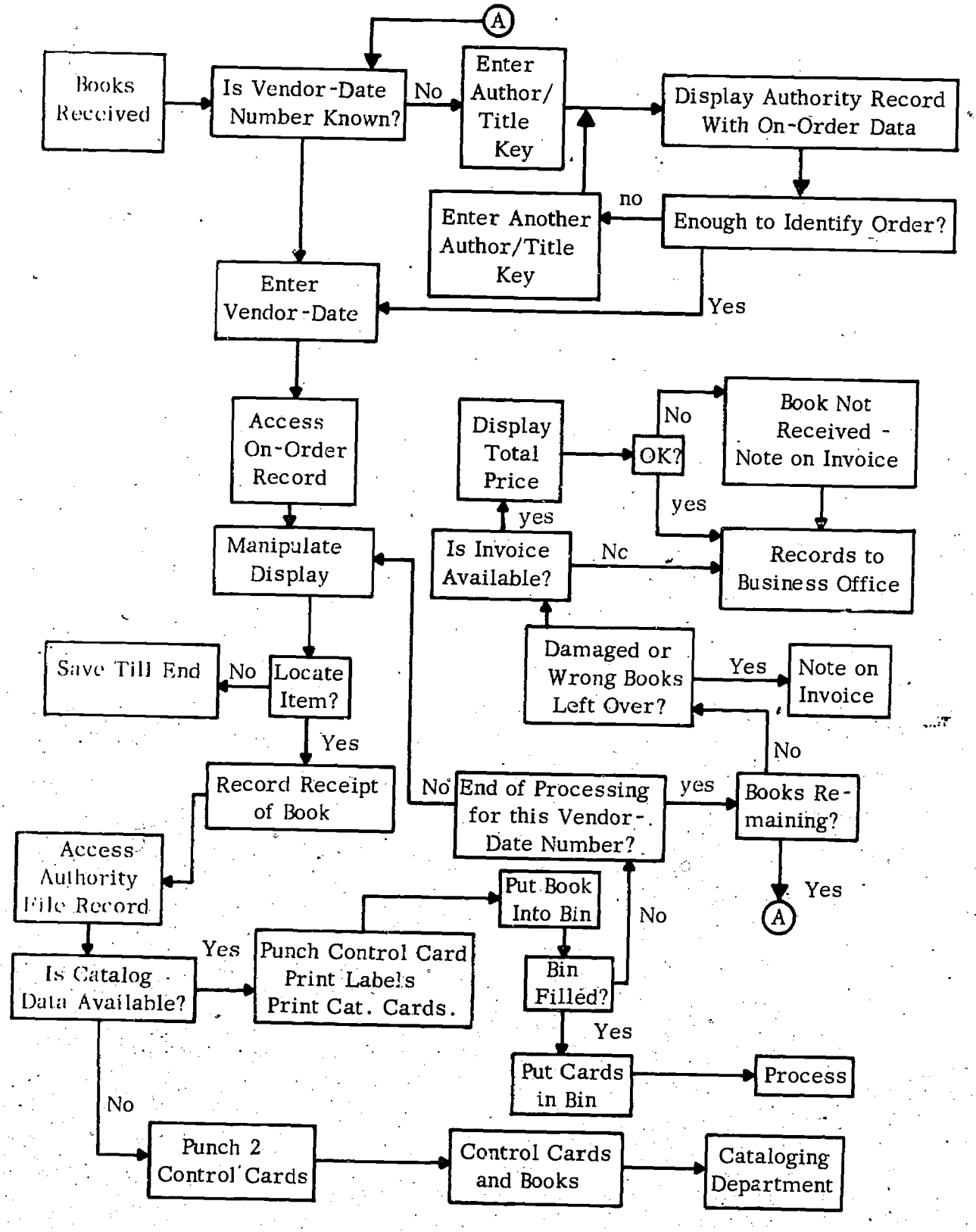


FIGURE 9 RECEIVING CYCLE

the proper one can still be chosen if different vendors were assigned. In those cases where there is more than one vendor-date number shown for this book containing the same vendor code, then another title must be selected until a unique vendor-date number becomes apparent. If not enough books are available to select a unique number, then the oldest vendor-date number is chosen.

To illustrate this process, suppose a book is received from vendor number 162 without proper documentation. In order to locate the item on-order record corresponding to this book we must first determine the vendor-date number. The author/title key of the book is entered into the console and the Authority File record for this book is displayed. Suppose the following vendor-date numbers were listed:

032110367, and 162102967.

Since the vendor is known as number 162 we choose the corresponding vendor-date number. Suppose the following were listed:

162110367, and 162102967.

Here we cannot choose between the numbers since they both correspond to the same vendor. The next step then is to enter the author and title of another book and go through the same process. If any displayed vendor-date number matches a previously noted one then this number is chosen. Finally, suppose only 1 book was sent by the vendor. We then choose the oldest vendor-date number, which in the above example is 162102967 corresponding to October 29, 1967.

If the vendor-date number is known from the invoice or packing slip,*it is keyed into the console directly. Initially, a position of the data for the first 5 items listed under the vendor-date number is displayed. The console operator will select a book and will proceed to cause the item record corresponding to this book to be displayed. Since the items are sorted within the record, this may be accomplished by indicating that the next sequential or previous 5 items be displayed. The console operator may also key in data which will cause the proper item to be displayed. Recalling that the items within the record are sorted first by publisher, then by author, it is evident that if the vendor for this order is a publisher then the first few letters of the author must be entered. On the other hand, if the vendor provides books of several publishers, then entering the first few letters of the publisher's name will cause the proper item to be displayed.

When the item is located properly on the display, the price and discount may be inserted if the invoice is available. The received date will be noted on the item on-order record. If an item cannot be located on the displayed record, it is to be set aside. When all items have been processed for a given vendor date number, these items may be identified by access to other vendor-date records, either by entering a new vendor-date number from the invoice or packing slip, or by accessing an

*It is expected that this will be the routine case. The exception procedure described above, however, insures that the center will be able to handle orders when the vendor-date number is not known.

Authority File record as previously described. This process is necessary since vendors will often ship books corresponding to a number of distinct vendor-date orders in a single shipment. If an item cannot be located, the console clerk will attempt to determine whether the item was sent in response to an order but was not the proper book. If such is the case, the invoice, if available, is credited the proper amount and the book sent with the invoice to the business office, with a note describing the circumstance, i.e., the desired book's identification. This procedure is also followed for damaged books.

Once the last item has been checked from an order, the invoice, or packing slip, if available, is checked for items billed but not received. Again credit is given on the invoice. The total net price is then displayed and checked against the invoice for accuracy. The final noted invoice or packing slip is initialed by the receiving clerk and is sent to the business office.

When an invoice is received by the processing center for books it has already processed, this same procedure is performed without the books. Each item on-order record which is displayed is checked to see if the book was actually received.

If the on-order record for an item indicates that the book has not been pre-cataloged then two control cards are punched at a nearby station and are placed in the book. These cards contain the vendor-date number and the temporary Authority File key. The book is then sent to the Catalog Department for cataloging. When it returns, a routine is used to enter it as before except that no invoice is needed since one of the control cards will be returned to identify the item.

Finally, if cataloging data is in the Authority record then a control card is punched, and the necessary catalog cards and labels are printed at a near-by location. Catalog cards will be printed two-up in upper and lower case characters according to the Library of Congress format. Cutting machines are currently available to make a clean edge on fan-fold perforated card stock which can operate at speeds compatible with a line printer. These cutters will clean cut both the horizontal and vertical edges of the card. The machines also act as bursters, presenting the operator with a stack of cards in the same order as the receiving clerks entered the books.

BOOK PROCESSING

Two console operators will place the books they process into a single book bin. When the bin is full, processing halts until the control cards, catalog cards, and labels can be collected and placed into the bin.

A bin full of books with matching control and catalog cards, and labels is then ready for processing. At the first station, book pockets are placed in a jig and the pressure sensitive labels are added. The labeled pocket and book card are placed in the appropriate book. The third label is affixed to the spine of the book, the control card placed in the book, and the batch is sent along to the next station.

Labels, catalog cards, and control cards in the bin should be in the same sequence that the books reach the first station. At the second station, the book pocket is pasted into the book. This can be accomplished at a rate of approximately 200/hour/worker. Plastic covers will probably not be appropriate for most of the books passing through. If they are, they should be affixed at station 2 prior to the pasting operation. One person can affix 90 covers an hour. The pasting operation would paste one end of the plastic cover to the book; the other would be open-ended. The pasting figure of 200/hour/person includes a percentage of books which would require pasting of the plastic cover.

The bin then moves to a final check point where catalog cards are checked against the book itself and then inserted into the book pocket. A control point is established here for all problems regardless of where they occur on the processing line. If a problem such as putting the wrong label on the wrong book develops, the book should be returned to the receiving consoles where a new set of cards and labels may be obtained.

SHIPPING

Fully processed books, containing control cards, will flow into the Shipping Department on a continuing basis. They will be placed in sections of shelves which are partitioned into groups for each library. Shelving will be done by looking on the control card for the ordering library's designation.

At the point when the books are to be shipped a marker is placed to distinguish those new books entering the shelves from those that are to be shipped. The control cards of the books to be shipped are collected and read into the high speed card reader. As each card is read, the on-order file is accessed and the date of shipment is recorded. A record consisting of an abbreviated author and title, the vendor-date number, and the ordering library's number is constructed. The entire list of orders is then sorted and printed to form a packing list for the shipment.

ORDER CANCELLATION AND DISTRIBUTION OF CHARGES

Once each week a batch processing program will handle both the claiming and canceling of orders and the distribution of charges to the libraries. This program will inspect each item on-order record in the on-order file in a serial fashion.

We believe that when an order for a book has been outstanding for a specified period of time, a claim procedure should be instituted. Thus, when the on-order record shows that the book was not received and the vendor-date number indicates the book was on-order for a given number of days, then a claim notice will be printed to the vendor. This notice will ask the vendor to report on the status of the order within a week, or the order shall be considered canceled. The date this claim notice was prepared will be entered into the on-order record. If the vendor replies that he is planning to fill the order then the claim date will be advanced. If he cannot fill the order, or does not reply to the notice, then the item on-order record will be purged from the file and placed on the order-exception queue which is associated with the ordering cycle. The console operator may now assign a new vendor. A listing of all orders which were canceled will provide the center with information on the status of orders and performance of vendors. In addition, the libraries may be informed of which books will be delayed because of the vendors inability to supply them.

In a concurrent operation with claiming and canceling orders, the distribution of charges to the libraries will be made. If a price has been included on the record, then a copy of the record is to be made on a magnetic tape file. This file will be sorted by library and will be printed to form a document indicating how the charges on the invoices received from vendors that week should be distributed. Thus, the total of the distributed charges should equal the total of all invoices processed that week. The invoices, vouchers, and distribution document will be forwarded to the Department of Audit and Control for processing.

We feel that full advantage of these accounting procedures should be taken by the libraries in order to augment their current methods for budgeting and accounting. For example, if the library's order number was keyed to departmental accounts, then in distributing the total charges the center could provide subtotals for these accounts.

ACCOUNTING PRACTICES

In this section we present a description of the center and its operations from an accounting and financial viewpoint. Specifically, we discuss (1) the documentation of the proposed system, (2) the adequacy of its audit trail, and (3) the internal control effects of the system's implementation.

1. Documentation

In connection with its accounting for books purchased for participating institutions, the center and its participating institutions will generate a number of documents which will be unique to the operation of the center. The first hard copy documentation generated by the system will be the original order which will be entered at the originating library on a data communication console. Physically, the original order will be a sprocket fed form similar to that currently in use at the University at Binghamton. On the order, each item will be specifically identified by the following: author(s); title; publisher; year of publication; edition; number of copies; and Library of Congress Catalog Card Number (optional).

In addition, each library may elect to number each document using the console. In the latter case, the library's order number will be transmitted to the facility.

The use of a form similar with those in current use permits the libraries to use the present procedures for ordering through the center. After entering an order, the form will be separated, and the copies used for normal purposes. Thus, when the center delivers the material, each individual library can use its normal procedure to confirm the fact the material was ordered, and record its receipt. Furthermore, this document will permit the participating institution to verify and approve the center's distribution of the charges against the institution's appropriations.*

The second hard copy documentation created by the center will be the weekly order register. This register is a listing created from a magnetic tape copy of the input order queue used to capture all orders received by the center. Abortive and incomplete orders are excluded from the tapes by an exception routine. The tapes, saved daily, will be merged and sorted to provide the order register listing for each library for the week. All the information appearing on the original orders, retained by the participating institutions, will appear on the order register. Therefore, the order register and the original orders provide both sides of the interface between the participating institutions' records and those of the center.

*It is anticipated that the center's operation will become reliable to the point where this secondary accounting at the libraries can be minimized.

The third hard copy documentation created by the center will be copies of the purchase orders. After the orders received by the facility have been assigned vendors and sorted by vendor, purchase orders will be prepared on a daily basis. Purchase orders will, in addition to identifying each ordered item, i.e., by author, title, etc., carry the facility's purchase order number which is composed of the date the book was ordered and the vendor number. Prepared by a computer print-out on a standard multi-part form, one or more copies of the purchase orders will be forwarded to vendors and at least one copy retained by the facility as an historical document.

The center's fourth type of hard copy document will be the vouchers forwarded to the Department of Audit and Control for payment. These vouchers will normally be composed of a state standard voucher form, which is prepared by the vendor; a listing of the books purchased, usually an attached vendor invoice; and initials to indicate that the invoice was proved, i.e., checked to see that all items were ordered and received and that all computations are correct. Normally, a voucher would also include the distribution of the resulting charges, but the center will provide this information to Audit and Control in a separate document.

The most significant factor about the voucher is that it will be the original hard copy record of receipt.

The weekly accounting distribution will be the center's fifth hard copy document. Weekly, the on-order file will be searched for items which have been received and priced. These items are those that appear on the vouchers processed during the week and their total should equal the ammended total of the invoices proved during the week. An accounting distribution of the charges to the various individual institutions will be obtained by sorting the items abstracted from the on-order file by individual libraries. Furthermore, optional coding of a library's initial order will permit the facility to distribute charges to specific accounts within the institution. In either case, the distribution will constitute the basis for Audit and Control's allocation of charges to the individual institutions' appropriations. The distribution is forwarded to the Department of Audit and Control and the appropriate sections will be forwarded to the participating institutions so that they may make any protest of the charges. The center will, of course, retain a complete copy of the distribution.

At the same time as the center prepares its distribution, it will from time to time use the on-order file to report all the open orders for each library. This open order report will have historical value only at the end of the fiscal year when it would be forwarded to the Department of Audit and Control so that encumberances may be created.

Weekly, the on-order file will be purged of all items which have been ordered, received, priced and shipped. This information will be printed out to create a final document and dumped onto magnetic tape to facilitate subsequent statistical analysis. Since this final document will reflect the liquidation of all the information on each completed transaction, it will be the most comprehensive source of historical information.

2. Audit Trail

In general, the documentation provides a clear audit trail which will permit subsequent audit and verification of the center's transactions. For example, if one were to select a cancelled voucher from the files of Audit and Control, he would find, as a minimum, on each voucher identification of the item(s), number of copies ordered, center's purchase order number, date received, and the net price. With this information, he would be able to trace the transaction to the retained purchase orders, to the order register, and to the specific library's original order. If that institution has properly retained its records, they would confirm that the library ultimately received the item and possibly the book could be found on the shelf. On the other hand, the same information from a standard voucher will permit the transaction to be traced to the purged on-order file listing and to the weekly accounting distribution. Other examples, of course, are easily made. We thus feel the proposed documents provide a clear audit trail.

3. Internal Control

In this system as in any, the greatest potential danger of defalcation arises from any opportunity to obtain cash directly from the system. Since the facility will not handle cash, except perhaps for petty cash, any direct method of obtaining cash from the system will have to be realized through the inducement of a fraudulent payment or diversion of a payment from its proper recipient. In either case, defalcation is unlikely. The center will authorize the Department of Audit and Control to make payment for a limited number of items, i.e., books, payrolls, supplies, miscellaneous services, and capital assets. The latter three items will be relatively immaterial or, in the case of capital assets, rare. As the standard procedures of the state will be used for these items, it must be assumed they will be adequately controlled.

The internal control unique to the center will result from external factors, the administrative supervision, and the procedures used within the center itself. The most significant external factor will be the Department of Audit and Control. The Department will pass upon the validity of each standard voucher forwarded to it, and remit directly to the vendors. With the limited number of approved vendors there is

virtually no opportunity for payments to be routed to a fictitious vendor. Thus, any defalcation involving the payment of a voucher will require collusion between an individual within the center and a vendor. Furthermore, usually every two years, the Department will conduct a detailed audit of the center. The second external factor providing control will be the participating libraries. If a participating institution maintains its original orders, and treats an order to the center as any other order, each accounting distribution sent by the center to the libraries will be tested and approved as if it were an invoice. If such is the case, any exception will be brought to the attention of the center's management and the Department of Audit and Control. Since the Department of Audit and Control will tie the total of charges distributed by the center to the payments made on its behalf, it is likely this procedure will detect any fraudulent payments or theft within the center. Also, the open order report sent periodically to the participating institutions should alert them if a fraudulent order has been attributed to them.

Within the center, administration in the form of direct supervision will be an effective control device. As the operation will be limited in size, most minor exceptions will be brought to the immediate attention of management. Furthermore, the size of the facility will permit management to directly observe and check the key procedural controls. In general, these controls include limiting the access to input consoles to the appropriate individuals, and limiting the access of these individuals to the computer. If such controls are in effect and the accounting distribution and other summary documents forwarded to the Department of Audit and Control are controlled from their creation to their mailing, they can function much as an auditor's confirmation.

At the same time, administrative supervision will be an effective control through the development of an informal management information system. The center is not so large that it needs a complex management information system, but of course an informal one will be required. It is anticipated that when appointed the director of the center will develop this system, which as a minimum will provide information on the number of exceptions, the type of exceptions, the unit cost of processing, overdue and slow moving items within the system. Such information may identify an obscure irregularity before they would otherwise be noted.

Given the external factors and effective administrative supervision present in the system, one can rely more securely on the internal procedures for control. As has been pointed out earlier, and elsewhere, the center will embody a number of procedures which will improve upon those now in effect in the technical services departments of the libraries. On the initial receipt of an order, the center will use a programmed routine to test each order for completeness. Daily, it will test to see that this order and all others received have been placed with a vendor by comparing the daily total of volumes ordered by the participating libraries to the daily total of volumes ordered from vendors. Furthermore, if a vendor does not respond to an order over a period of time,

the center will cancel that order and reissue a new order to another vendor. On the basis of the survey made by A.D.L., this represents a significant improvement in procedures. Several libraries noted that staff limitations prevented them from regularly cancelling old unfilled orders. Furthermore, manual procedures offer no test comparable to the routine test of completeness proposed here.

As a result of the planned receiving procedures, the center will refuse to accept books that it has not ordered and will return them to the respective vendors. As invoices will be proved at the time of receipt, each item on every voucher approved for payment will have been ordered and received. Procedural controls will provide for more rapid processing of vouchers for payments. Standard vouchers and invoices received by the center will be processed and forwarded to the Department of Audit and Control weekly. Simultaneously, charges will be distributed to the appropriate libraries' accounts. In combination, this will provide the librarians, the university administration, and the Department of Audit and Control with more timely information on book expenditures.

Last but not least, the on-order file will provide an in-house inventory which may be compared with a physical count of material on hand. This will permit management to identify lost or stolen items.

TRANSPORTATION

To achieve weekly delivery of books to each institution, we considered two alternatives. One method of delivery would be the use of the processing center's own vehicle for delivery to the 25 libraries in Phase II. A second method we considered was the use of common carriers on a scheduled basis.

Rates for common carrier hauls in less than truckload lots were obtained from two carriers. The volumes of books to be delivered to each library were converted to pounds assuming an average of 2 pounds per book when packed, and the average cost of weekly delivery to each campus was calculated. As shown in Figure 10 the total annual cost of delivery using common carrier is estimated to be $17,300.

In estimating the cost of delivery by the center's own vehicle, we assumed that one truck would carry a weekly load to each library on a scheduled basis. To handle the six tons of books in one shipment, a tractor-trailer would be required. The driver would have to be away overnight, for which premium wages must be paid. The estimated yearly costs for a private truck to deliver the required books are:

COMMON CARRIER
DELIVERY COSTS

	TO:	LBS/WK.	$/cwt.	$/WK.	$/YEAR (50 WKS.)
	Albany	1,200	2.35	28.30	1,415
	Binghamton	1,200	2.49	29.88	1,494
	Buffalo	1,200	2.94	35.28	1,764
	Stony Brook	1,200	2.25	27.00	1,350
	Poughkeepsie	1,120	1.85	20.72	1,036
	Oneonta	920	2.67	24.56	1,228
	Potsdam	800	3.09	24.72	1,236
	Plattsburg	800	3.01/+14c/cwt. arbitrary	25.10	1,260
	Brockport	520	(2.94)	15.28	764
	Buffalo	200	3.18	6.36	318
	Farmingdale	400	2.32	9.28	464
	Cortland	400	2.84	11.36	568
	Suffolk	368	(2.50)	9.00	450
	Nassau	312	(2.32)	7.19	360
	Syracuse	292	2.93	8.50	425
	Canton	280	(3.09)	8.65	432
	Jefferson	240	(3.00)	7.20	360
	Corning	200	6.05 total minimums	6.05	302
(Monroe)	Rochester	196	6.15 total minimums	6.15	306
	Cobleskill	188	6.05 total minimums	6.05	302
(Erie)	Buffalo	120	6.15 total minimums	6.15	307
	Delhi	120	5.95 total minimums	5.95	297
	Morrisville	112	6.05 total minimums	6.05	302
	Fulton	94	6.05 total minimums	6.05	302
	Syracuse	76	6.05 total minimums	6.05	302
					$ 17,344

NOTE: Rates are from White Plains
( ) = estimated rates

FIGURE 10

Driver	$ 10,000
Fringe benefits	3,000
Tractor - $15,000 amortized for 5 years	3,000
Trailer - $6,000 amortized for 10 years	600
Insurance	3,000
Operating expenses for 90,000 miles at 6 cents/mile	5,400
Maintenance	400
TOTAL:	$ 25,400

This estimate does not include a back-up vehicle, a relief driver, or the drivers' expenses. On this basis, we believe that the use of a common carrier to deliver books to each library on a weekly basis is more economical than the use of the center's own truck, and recommend this method for Phase II.

STAFF

For Phase II, all personnel discussed in Phase I will be required. In addition, part-time help for the actual processing operation as well as additional miscellaneous staff are required. We discuss specific additions to each department as well as the functions of each department in this section.

Library Department.

The library department, under the direction of a chief librarian, is responsible for all cataloging and order functions. It has primary responsibility for the content of the Authority File and preparation of catalog update runs. The four senior clerks will operate the receiving consoles on a full-time basis. The three senior library clerks will have responsibility for all ordering, including console processing of exceptions and special orders which must be handled manually.

Business Department

The business department has the responsibility for purchasing all supplies and equipment. In addition it has charge of all financial and accounting aspects of the center's operation including the distribution of charges to libraries, and payments of invoices from vendors. It should be in continual contact with the Department of Audit and Control,

and should report to the director on a regular basis on items concerning the center's financial position and budget.

Data Processing Department

The data processing department has responsibility for all central and peripheral computing equipment including communications facilities. The programming staff should be continually making improvements in the programs and working with outside organizations when the need arises. The keypunch operators will be available for punching both programs and data, such as for the catalog update run. The assistants are required for manning the peripheral equipment associated with the receiving function.

Processing Department

The processing department should hire and train part-time personnel for the book processing function. The equivalent of 10 full-time staff members is required. Two senior clerks will be responsible for the processing line operations, and will perform quality control functions.

Miscellaneous Services

The miscellaneous services department has the responsibility for shipping of books, as well as maintenance functions. It should add a maintenance man and assistant shipping clerk at the beginning of Phase II.

Equipment locations and work stations are indicated on the layout shown in Figure 11.

BUDGET FOR PHASE II

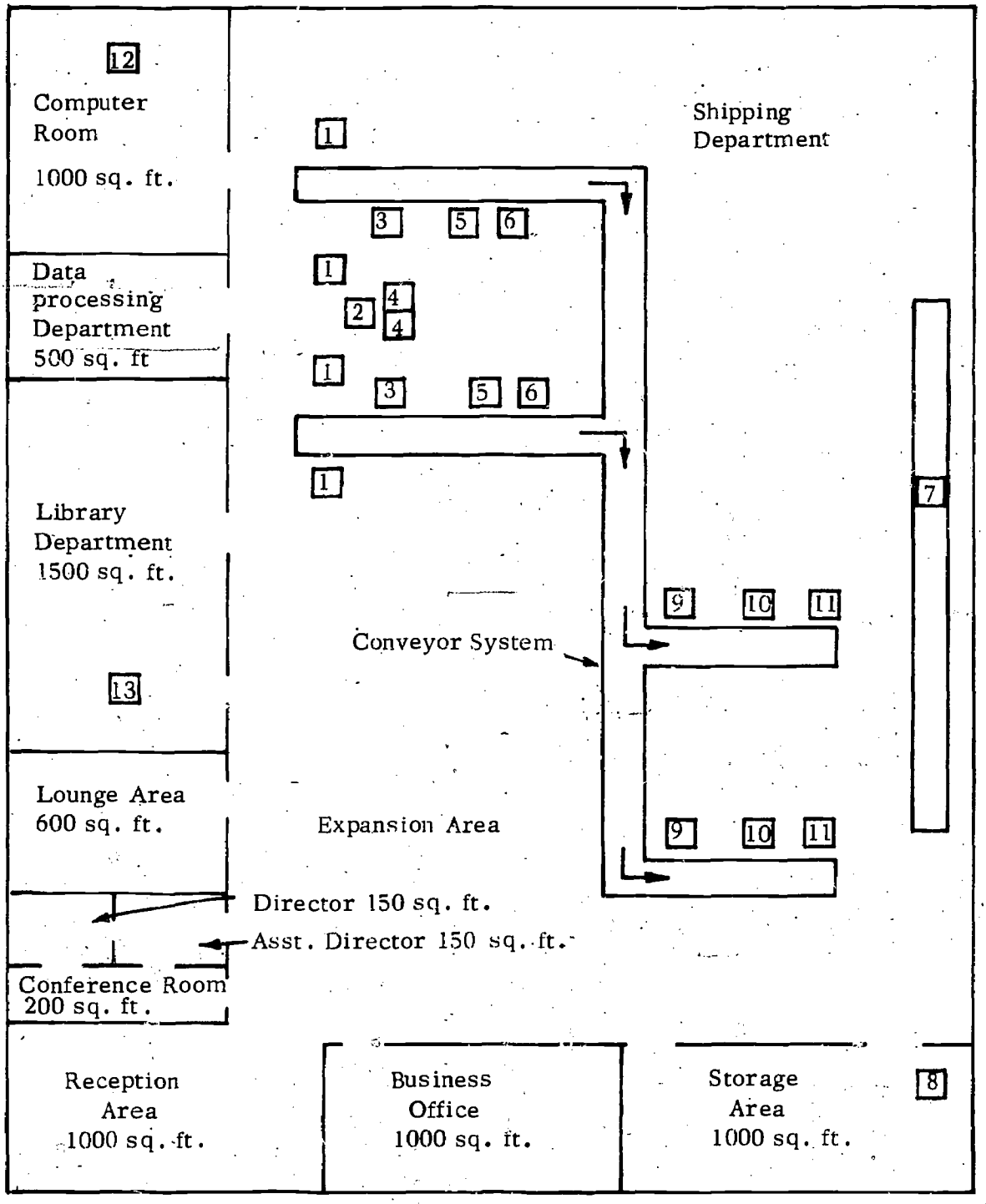
In this section we present an estimated budget for the nine month Phase II period of July 1967 through April 1970.

STAFF

The second phase staff requirements were outlined in the previous section.

Administration

	Director	for	9	months	at	18,000	per annum	$13,500
	Asst. Director	"	"	"	"	16,000	" "	12,000
(2)	Secretaries	"	"	"	"	5,000	" "	7,500



KEY:
1 - Receiving Console/Display
2 - Control Card Punch (Exceptions)
3 - Label Serial Printer or Typewriter
4 - Control Card Punch
5 - Cutter
6 - Line Printer
7 - Shipping Shelves
8 - Printing Equipment
9 - First Processing Station
10 - Second Processing Station
11 - Third Processing Station
12 - Computer
13 - Order Processing Console with Printing Device

FIGURE 11 EQUIPMENT LOCATIONS AND WORK STATIONS

	Miscellaneous Services						
	Admin. Asst.	for 9	months at	10,000	per	annum	7,500
	Maintenance Man	"	"	7,500	"	"	5,625
	Maintenance Man	"	"	5,000	"	"	3,750
	Senior Driver	"	"	6,500	"	"	4,875
	Sr. Shipping Clerk	"	"	6,500	"	"	4,875
	Asst. Shipping Clerk	"	"	5,000	"	"	3,750
	Offset Machine Operator	"	"	5,000	"	"	3,750
	Personnel Clerk	"	"	5,000	"	"	3,750
	Switchboard Operator	"	"	4,000	"	"	3,000
	Library Department						
	Chief Librarian	for 9	months at	14,000	per	annum	10,500
	Senior Cataloger	"	"	12,000	"	"	9,000
(5)	Senior Library Clerks	"	"	5,000	"	"	18,750
(2)	Catalogers	"	"	9,000	"	"	13,500
(4)	Senior Clerks	"	"	5,000	"	"	15,000
(4)	Clerk/Typists	"	"	4,000	"	"	12,000
	Business Department						
	Business Manager	for 9	months at	14,000	per	annum	10,500
	Secretary	"	"	5,000	"	"	3,750
	Senior Clerk	"	"	5,000	"	"	3,750
	Clerk Typist	"	"	4,000	"	"	3,000
	Data Processing Department						
	Data Processing Manager	for 9	months at	14,000	per	annum	$ 10,500
(2)	Computer Programmers	"	"	10,000	"	"	15,000
	Assistant Manager	"	"	12,000	"	"	9,000
(2)	Computer Operators	"	"	9,000	"	"	13,500
(4)	Assistants	"	"	5,000	"	"	15,000
	Secretary	"	"	5,000	"	"	3,750
(2)	Keypunch Operators	"	"	4,000			6,000
	Processing Department						
	Processing Manager	for 9	months at	14,000	per	annum	10,500
(2)	Senior Clerks	"	"	5,000	"	"	7,500
	Part-time Employees (the equivalent of 10 full-time clerks)	"	"	4,000	"	"	30,000
	SUBTOTAL:						294,375
	PLUS 20% FRINGE BENEFITS						58,875
	TOTAL:						$ 353,250

SUPPLIES AND EXPENSES

In addition to those supplies and expenses listed in Phase I, we include here costs for terminal equipment and communication lines for the nine months of Phase II. Our cost estimate for these items are developed in Appendix E.

Insurance	$ 3,000
Processing Supplies	25,000
Office Supplies	10,000
Utilities	5,000
Travel	5,000
Services	5,000
Postage	5,000
Vehicle Maintenance	2,000
Data Processing Equipment	270,000
Terminal Equipment for 25 Libraries	30,000
Communication Lines	18,000
Bibliographic Tools	5,000
Building Rental	36,000
Common Carrier Delivery	18,000
	$ 437,000

TEMPORARY SERVICES

Additional computer programming assistance from outside organizations will be required both to implement major changes in programs as a result of operational experience and to begin programming for expansion into Phase III. Our estimate of this additional expense is $40,000.

SUMMARY BUDGET

For the 9 month period of Phase II we estimate the following budget will be required:

Staff	$ 353,250
Supplies and Expenses	437,000
Temporary Services	40,000
TOTAL:	$ 830,250

At the completion of Phase II the center will be processing books at the rate of 300,000 per year. The expansion of service marks the beginning of Phase III.

PHASE III. EXPANDING THE SERVICE

INTRODUCTION

Phase III, to commence about April 1970, will involve three distinct objectives. These objectives are

- to expand service to all SUNY libraries;
- to expand the kinds of services the center will offer; and
- to develop plans for the center in light of new policies and long-range goals.

Since the center will be in full operation at this time, budget figures reflect both an operating budget and further development costs as separable items.

EXPANDING SERVICE TO ALL LIBRARIES

The process of expanding the center's service to all libraries in the SUNY system primarily involves changes in the communications network, and an upgrading of the center's processing facilities.

In the area of expanding the communications network we considered three alternative methods. The three possibilities would be to increase the speeds of terminal devices and maintain Phase II communication lines; to retain Phase II terminal equipment and increase the number of communications lines; or to keep Phase II terminal equipment and utilize regional message concentrators.

It would seem that the daily order transmission times developed in the previous section would not warrant the use of the more expensive terminal devices with increased transmission speeds. We recommend the utilization of regional message concentrators rather than an increase in the number of trunk lines to provide complete simultaneity of transmissions and allow inter-library communications to develop on a regional basis. The message concentrators would be located at each of the four university centers. This equipment would now perform the operation of gathering order data, and would route messages between libraries and between a library and the center. A configuration for a communications network utilizing such equipment is shown in Figure 1.

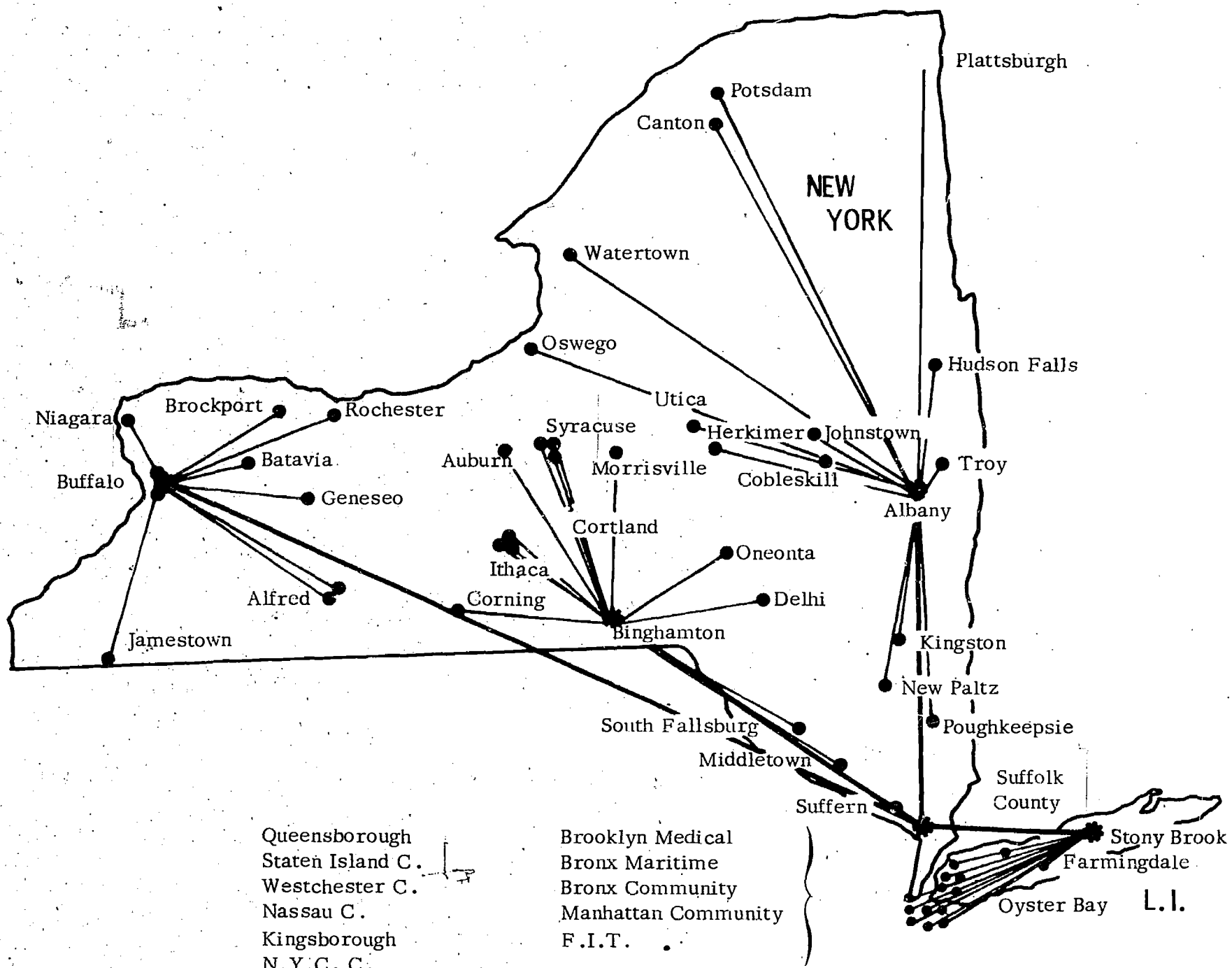


FIGURE 1 PHASE III COMMUNICATIONS NETWORK

Since each library may now be communicating with the center through the message concentrators at the same time, the polling scheme used in Phase II is no longer required. The libraries may initiate the order transmission process at any time during the day.

Other functions to be handled by the regional concentrators include pre-formatting of the order data and error checking operations.

EXPANSION OF THE SERVICES OFFERED

Foreign Titles

The center should provide the capability to order foreign titles as the first additional service since the ordering procedures are similar to those for current American titles. Relationships with foreign book suppliers need to be developed. The center should examine the contents of the Authority File to determine the need for additional data on foreign items. We suspect that the initial sources for cataloging data would not have provided a sample of foreign titles rich enough to satisfy the center's needs. Some addition of cataloging data would be required and the center should look for sources of this data. Two methods of enriching the Authority File are clear. One would be for the center to prepare its own material in machine-readable form, working from printed tools of cataloging data. A second possibility would be to elicit data on foreign items from the SUNY libraries themselves, using the communications facilities and equipment already in use. This second method has the additional advantage of providing actual data for the union catalog on the location of foreign titles.

Figure 2 shows our estimates of the number of volumes ordered through the center by all libraries, including orders for foreign materials.

Periodicals

Procedures for the ordering of periodicals would not include any processing activity. The center can, however, provide service in this area by keeping records on periodical subscriptions and handling the re-order function for the libraries.

Out-of-Print Material

We believe that before procedures can be effectively established for processing out-of-print material, the center can provide service by coordinating the purchases of these items. A list of out-of-print titles which each library desires can be transmitted to the center and a single listing of titles prepared. This listing can receive wide distribution to out-of-print book suppliers.

Eventually, the libraries may look to the center for the actual ordering of out-of-print materials. The center should have a searching staff and maintain active awareness of the out-of-print market. These items would not be subject to the same time scale as current titles. Full processing of out-of-print books should bring the center's total processing close to 900,000 volumes per year. It is expected that this service would become operational around 1973.

PHASE III

YEARLY PROCESSING VOLUME

Number of Libraries	Type of School	Volumes Each	Total
4	University Center	50,000	200,000
11	Four Year College	20,000	220,000
6	Agriculture and Technical	5,000	30,000
4	Specialized College	4,000	16,000
5	Contract College	3,000	15,000
32	Community College	3,000	96,000
		TOTAL	577,000

FIGURE 2

Interrogation—

In addition to expanding its service to other types of books, the center should develop programs which would allow each library to have access to the files. Early in Phase III, a program permitting the libraries to query the on-order file should be in operation. The library should be able to receive reports on the status of an individual item on order, or a complete listing of all items on order. This capability can be easily implemented with the communications network suggested for Phase III. It will allow the individual library to check if an item is on order before placing another order for the same item.

Some upgrading of the center's processing capacity will be required in response to the expansion of service to all libraries. The details of this upgrading should rely heavily on operating experience gained in Phase II.

PHASE III ANNUAL BUDGET

By about 1973 then, the processing center should be in full operation. Its services will have been expanded to the point where just about all books purchased by the SUNY complex of libraries are done so through the center. The center will in fact have become an integral part of the library complex, and its performance will have evolved into a smooth, production type operation. The libraries will have come to expect good service from the center, including fast delivery, accurate accounting, and helpful reporting. The libraries' traditional procedures for ordering, accounting, filing, keeping records, dealing with suppliers, returning damaged books, pasting, labeling and the like will have dissipated. By this time, the familiar console and the ability to utilize it to order books and gain access to the data base, will be regarded as necessary tools for effective library functioning.

The establishment of this environment through a series of evolutionary phases has constituted the scope of this study. We present here a detailed annual operating budget for the center when it is in full operation, about 1973. In addition to this operating expense, further developmental expenses, estimated at $100,000, will be required in moving from Phase II to this Phase III system. By 1973 we expect the center to be processing about 800,000 volumes annually.

STAFF

	Administration	
	Director	$ 18,000
	Asst. Director	16,000
(2)	Secretaries at 5,000 each	10,000
	Miscellaneous Services	
	Admin. Asst.	10,000
	Maintenance Man	7,500
	Maintenance Man	5,000
	Senior Driver	6,500
	Driver	5,000
	Senior Shipping Clerk	6,500
(2)	Shipping Clerks at 5,000 each	10,000
	Offset Machine Operator	5,000
	Personnel Clerk	5,000
	Switchboard Operator	4,000
	Library Department	
	Chief Librarian	14,000
	Senior Cataloger	12,000
(7)	Senior Library Clerks at 5,000 each	35,000
(4)	Catalogers " 9,000 "	36,000
(6)	Senior Clerks " 5,000 "	30,000
(4)	Clerk/Typists " 4,000 "	16,000
	Business Department	
	Business Manager	14,000
	Secretary	5,000
(2)	Senior Clerks at 5,000 each	10,000
	Clerk/Typist	4,000
	Data Processing Department	
	Data Processing Manager	14,000
	Assistant Manager	12,000
(2)	Computer Programmers at 10,000 each	20,000
(2)	Computer Operators " 9,000 "	18,000
(6)	Assistants " 5,000 "	30,000
(2)	Secretaries " 5,000 "	10,000
(2)	Keypunch Operators " 4,000 "	8,000

Processing Department		
Processing Manager		14,000
(4) Senior Clerks at 5,000 each		20,000
Part-time employees (the equivalent of 15 full-time clerks) at 4,000 each		60,000
	SUBTOTAL	470,500
	PLUS 20% FRINGE BENEFITS	94,100
	TOTAL:	$ 564,600

SUPPLIES AND EXPENSES

Insurance	$ 10,000
Processing Supplies	125,000
Office Supplies	15,000
Utilities	10,000
Travel	8,000
Services	10,000
Postage	15,000
Vehicle Maintenance	5,000
Data Processing Equipment	360,000
Terminal Equipment	108,000
Remote Processors	72,000
Communications Lines	48,000
Bibliographic Tools	5,000
Building Rental	48,000
Common Carrier Delivery	50,000
	$ 889,000

SUMMARY BUDGET

The annual operating budget for the center when it is in full operation is:

Staff	$ 564,600
Supplies and Expenses	889,000
TOTAL:	$ 1,453,600

APPENDIX A

SURVEY OF LIBRARIES

In this appendix, we present a summary of the results obtained from a questionnaire and a series of interviews with librarians at the 25 institutions which were used in planning for Phase II operations.

These questionnaires and field interviews supplied us with information concerning the current procedures now in use in SUNY libraries, the major needs which these libraries are currently experiencing, and the librarians' views toward a centralized processing center.

In ordering current American titles, the libraries reported that the first vendor contacted was able to supply an average of 83% of the volumes requested.

In considering the time interval between placement of an order and receipt of the greater part of the order, the libraries were asked to estimate current experience and indicate what they felt would be reasonable to expect in receiving fully processed books via the center. In general, they seem to expect the center to equal current time intervals, with the exception of a slight tendency to give the center an extra week or so. Specifically, 52% of the libraries currently experience delivery intervals of six weeks or more, and 64% consider six weeks or more reasonable to expect.

Discounts the libraries generally received average 35.1% for trade books and 12.1% for technical books.

Only 32% of the libraries have a system of automatic cancellation of orders. For the eight libraries which do, the approximate number of days before automatic cancellation occurs ranges from 30 days to more than 120 days.

All of the respondents indicated that it would be helpful to have a SUNY centralized processing center with the exception of two university center librarians who did not answer and two college librarians who did not know.

It was felt that the center would be helpful:

a. in the ordering, cataloging and processing of books - by 88% of the respondents;

b. by providing a printed book catalog having three separate approaches (author, title, subject) - by 80%;

c. by providing the capability to order anything, including old and new books - by 64%;

d. by providing non-book materials - by 44%;

e. in the ordering and cataloging of periodicals - by 28%;

f. by providing the capability to order only new books - by 24%; and

g. in providing assistance in the selection of books and other related materials - by 16% (all community college librarians).

Twelve respondents specified ways in which the center would not be helpful. These responses either had to do with special situations such as rush orders, gift books, and existing arrangements with foreign book dealers, or they reflect apprehensions over loss of autonomy.

Respondents were asked to estimate average current costs per volume for book processing and then to indicate the average cost per volume they could afford to pay the center for processing. The answers to the first question were dispersed over the range from $1.50 to more than $4.50, with five not answering and two saying they could not afford centralized processing on their current budgets.

While a comparison of responses to these two questions is not particularly meaningful, they do serve to highlight the hesitancy of the respondents to commit themselves to paying an amount for central processing which would impose restrictions on their budgets and perhaps cut into the size of their staffs. It was difficult for them to judge what should be included in "processing" and what would be included in "central processing" and what functions would remain for their staff to handle. Evidence for this conclusion was supplied by various comments as well as the fact that while seven respondents indicated that they currently pay more than $4.50 per book, only one could afford to pay that amount to the center. Four respondents indicated that they were thinking of costs from order initiation to shelf, and one gave costs for cataloging only.

Those who replied to the question asking for reasons for any difference between what they now pay and what they could pay the center gave more evidence of their hesitancy and uncertainty. Reasons given included: need the balance for hidden costs; have to handle special material; still have costs for ordering, checking in, shelving, changes; the administration would object to a greater amount; and no reason since it can't be cheaper.

The mode of book delivery preferred by half of the respondents is a special SUNY delivery truck, with six in effect having no preference and three saying the fastest method, whichever that would be.

Only rough approximations are afforded by respondents' indications of functions performed by professional and non-professional staff. These suggest that in total about half the professional and two-thirds of the non-professional staff time is spent on acquisitions and cataloging.

A tabulation of responses to statistical questions is presented in Figure A-1.

PHASE II. LIBRARY STATISTICS

Library	Volumes in Collection		Volumes Purchased		Current American Volumes Purchased		Full-Time Staff	
	1966	1970	1966	1970	1966	1970	1966	1970
University at Albany	235,949	690,667	51,030	135,000	25,500*	30,000*	65	327
University at Binghamton	222,000	500,000	72,320	209,125	11,000*	30,000*	69	182
University at Buffalo	726,374	1,328,760	71,513	128,000	10,000	30,000*	160	280
University at Stony Brook	202,012	542,000	118,546	100,000	28,000*	30,000*	125	240
College at New Paltz	151,182	300,000	29,101	41,000	22,000	28,000	31	74
College at Oneonta	129,735	237,525	13,268	35,000	8,956	23,000	33	51
College at Potsdam	68,133	155,000	9,909	25,000	6,300	20,000	22	50
College at Plattsburgh	115,434	223,000	18,007	25,000*	12,600	20,000*	28	40
College at Brockport	105,000	195,000	20,000	20,000	---	14,000*	10	40*
College at Buffalo	119,096	244,156	23,874	35,000	14,916	21,000	36	60
College at Farmingdale	51,601	105,000*	20,000	20,000	---	10,000*	14	20*
College at Cortland	94,000	164,000	18,000	28,000	8,000	10,000	30	42
Suffolk Community	17,000	51,000	3,700	10,000	3,300	9,200	5	10
Nassau Community	32,404	72,000	10,000	10,000	7,800	7,800	15	26
Onondaga Community	24,547	52,792	5,092	7,345	---	7,300*	4	14
College at Canton	22,750	42,000	3,806	7,000	---	7,000*	6	12
Jefferson Community	11,156	39,500	5,002	6,500	4,700	6,000*	3	8
Corning Community	18,000	35,000	3,000	6,000	1,500	5,000	6	12
Monroe Community	21,900	42,000	4,506	4,900	---	4,900*	9	12
College at Cobleskill	20,500	45,700	3,100	7,000	2,000	4,800	8	16
Erie Technical	25,000	44,000	---	2,500*	---	3,000*	7	10*
College at Delhi	25,000	75,000	2,535	5,000*	---	3,000*	6	12*

FIGURE A-1

PHASE II. LIBRARY STATISTICS

Library	Volumes in Collection		Volumes Purchased		Current American Volumes Purchased		Full-Time Staff	
	1966	1970	1966	1970	1966	1970	1966	1970
College at Morrisville	32,715	57,000	8,346	6,000	3,900	2,800	7	10
Fulton-Montgomery Community	6,000	18,000*	---	3,000*	---	2,400*	3	5
College of Forestry	16,719	45,000	1,710	3,500	850	1,900	11	23

*Figures estimated by A.D.L.

FIGURE A-1
(Continued)

APPENDIX B

FILES AND FILE ORGANIZATIONS

In this appendix we present details on the various files required for the operation of a centralized processing center. We discuss record content, file organization and retrieval mechanisms, and estimated file sizes.

AUTHORITY FILE

The Authority File is by far the largest and most complex of the files to be considered. It contains cataloging data for each unique title processed by the center, on-order records, and an indication of which libraries have this item. The records are of variable length, averaging about 500 characters. In addition, the majority of the fields within a record is variable length, suggesting the use of a field table for each record. Fields which correspond to items in the Library of Congress MARC format should be tagged accordingly. In Figure B-1 we show the possible content of an Authority File record. Each of the fields need not be present for any particular record, however.

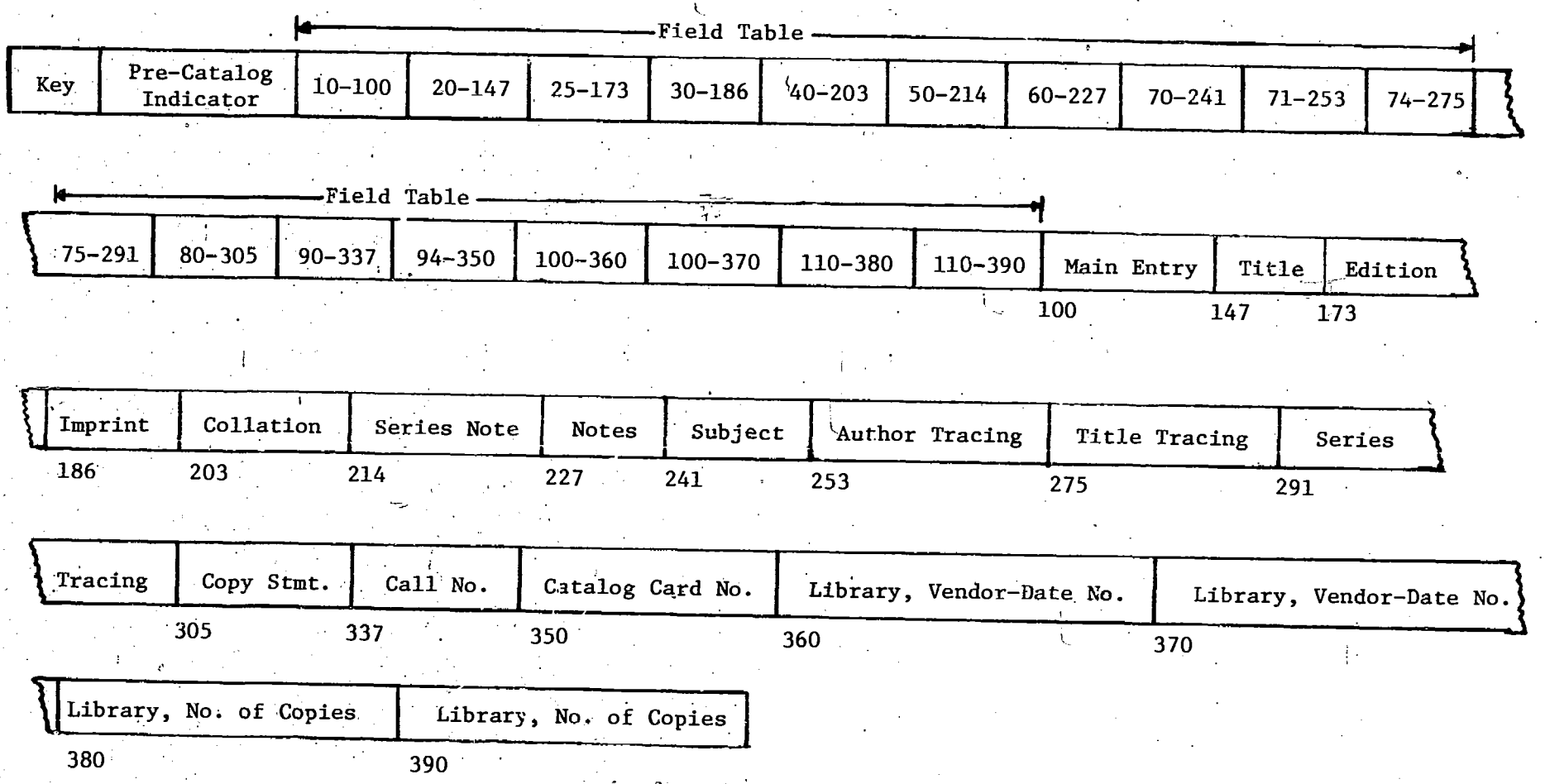
We estimate that between two and four hundred thousand records will be available for the file at the initiation of Phase II. We have planned for an ultimate file size of one million records. The demands upon the file for access by author/title key and by sequence (i.e., the ability to ask for the previous or next item, without giving a key) will require the use of several levels of index tables. We suggest such a scheme be based on an index sequential file organization. The exact details of this organization must await selection of the specific random access devices to be used.

ON-ORDER FILE

The on-order file contains vendor-date records for all outstanding orders. These records consist of a header followed by a number of sorted item on-order records. The item on-order records are a fixed length of 158 characters, although the number of such items which constitute a vendor-date record will be variable. The items within a vendor-date record are blocked into "pieces" of 20 items each. The content of a vendor-date record is shown in Figure B-2.

Individual items may be purged from this file at any time. A file maintenance routine is thus required to re-arrange the items within a vendor-date record and shorten its total length.

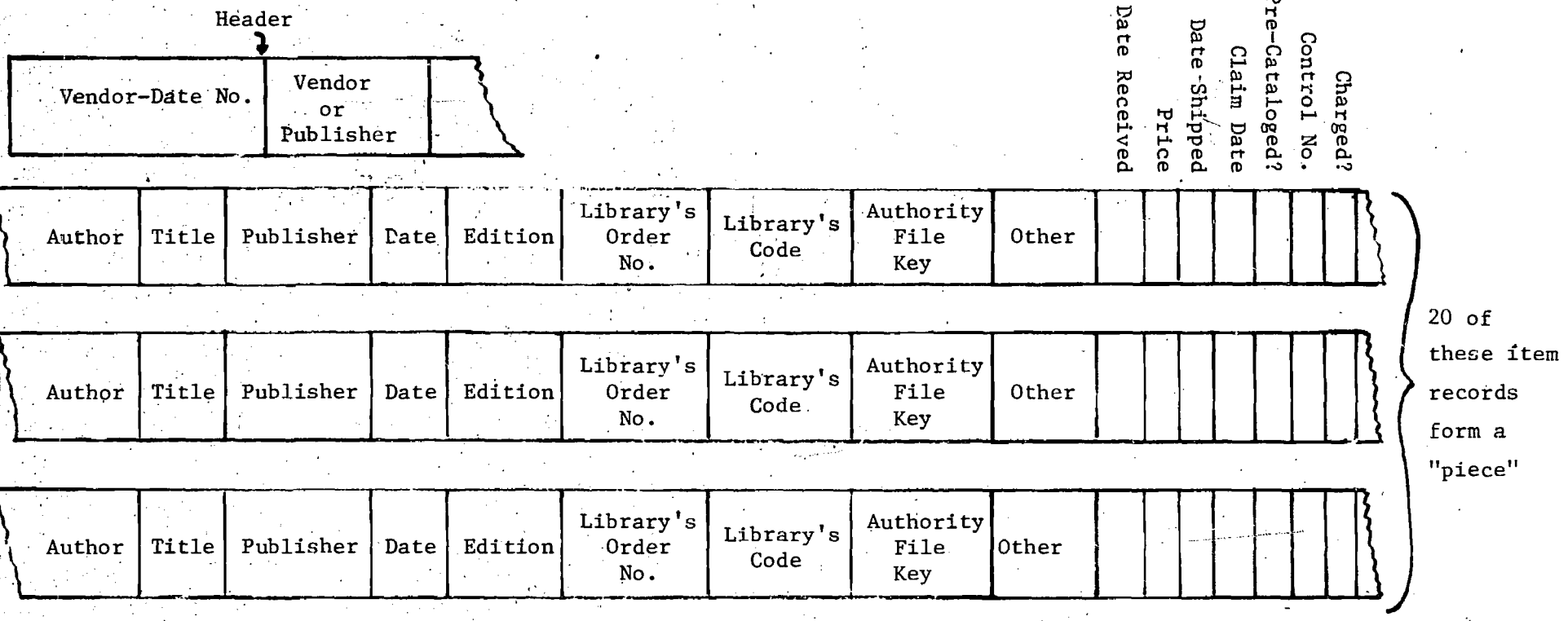
AUTHORITY FILE RECORD CONTENT



The field table gives for each field number, the character position within the record of the beginning of that field. For example, field 10 begins in position 100; field 20 in position 147. All fields for cataloging data (those between 10 and 94) follow the MARC format. Fields 100 and 110 are used for illustration purposes.

FIGURE B-1

VENDOR-DATE RECORD CONTENT



The item records are sorted alphabetically by publisher, within publisher by author.

FIGURE B-2

Since items may be purged from the file upon the distribution of charges, if we assume 8 weeks from placement of an order to its subsequent charge to a library then at the rate of 1300 orders per day, the on-order file will average 52,000 items at any given time during Phase II. These items may be grouped into a maximum of about 12,000 vendor-date records if all 300 vendors were used each day. We suspect the number of vendor-date records will be considerably less since a few vendors will probably be used quite heavily and most others on a relatively infrequent basis. All access to vendor-date records will be based on a table look-up procedure.

LIBRARY FILE

The library file, to be maintained either on magnetic tape or disc, will contain the names and addresses of the participating SUNY libraries, including the corresponding library code. This file will be used in printing packing slips and for any purpose which requires this data.

VENDOR FILE

The vendor file will contain the names and addresses of all regularly used vendors and whether the vendor is a publisher or not. Again, the file may be on magnetic tape or disc, arranged sequentially by vendor number. The file will be used in printing orders to vendors.

INPUT ORDER

The input order queue will contain the original data of all orders as it is received from the communication lines. It need only hold one day's amount of orders. At a maximum (in Phase II) this would be approximately 750,000 characters, assuming 250* characters per order and a peak factor of 3,000 orders.

We have indicated the input order queue would reside on a disc file although magnetic tape would suffice.

OTHER FILES

All other files, such as the file of purged on-order records, the file of the distribution of charges, and the file used for printing orders to vendors, should be held on magnetic tape for historical and statistical purposes.

*We use 250 characters per order here to insure that the estimate is not low. Elsewhere we use the figure 200 which is the planning figure adopted for routine estimations.

APPENDIX C

PROGRAM FLOW CHARTS AND DESCRIPTIONS

ORDER PROCESSING PROGRAM

The order cycle consists of two distinct phases; a computer processing phase and a manual exception processing phase utilizing a display and the computer. The computer processing phase starts with a record from the on-order queue (a block of ten orders resident in core) assigns a vendor-date key, updates the Authority File record, and stores the order on a print queue for generation of book orders. Those orders which are exceptions (due for example to incomplete ordering information or lack of an Authority File record) are stored on an exception queue. This queue may be processed after the first phase is complete or concurrently. Exception processing will require use of a display console by a senior library clerk. It is initially assumed that the two phases are not concurrent.

The order processing program has been flowcharted in Figure C-1. It begins by retrieving an order from the input order queue. At this time, the file is sensed to determine if this is the last record. If not, the number of copies ordered is stored as an index and a publisher code is constructed. The publisher code is compared against the vendor assignment table publisher list; if a match occurs sensing to determine multiple vendor assignment is performed. If not a multiple vendor entry, the vendor order quantity is incremented by one and the author/title access key for the Authority File is generated from the order being processed. The Authority File is accessed by this key. If a match occurs a vendor-date number, formed from the contents of the vendor assignment table and the date is added to the Authority File record and the Authority File record is updated. An on-order record is constructed and written on magnetic tape during this pass. Orders for "N" books are written as "N" records for a single book each. Order printing and generation of a sorted on-order file for disc are subsequently performed from the tape records in a batch mode.

If no match with the publisher list of the vendor assignment table occurs, the order is stored in the order exception queue on disc. This also occurs if author and/or title are not in the original order. Similarly, if no match is found on the Authority File, and another Authority File access by means of a new Authority File key (constructed, for example, by using the second of two authors) results in no match, storage on the exception queue results.

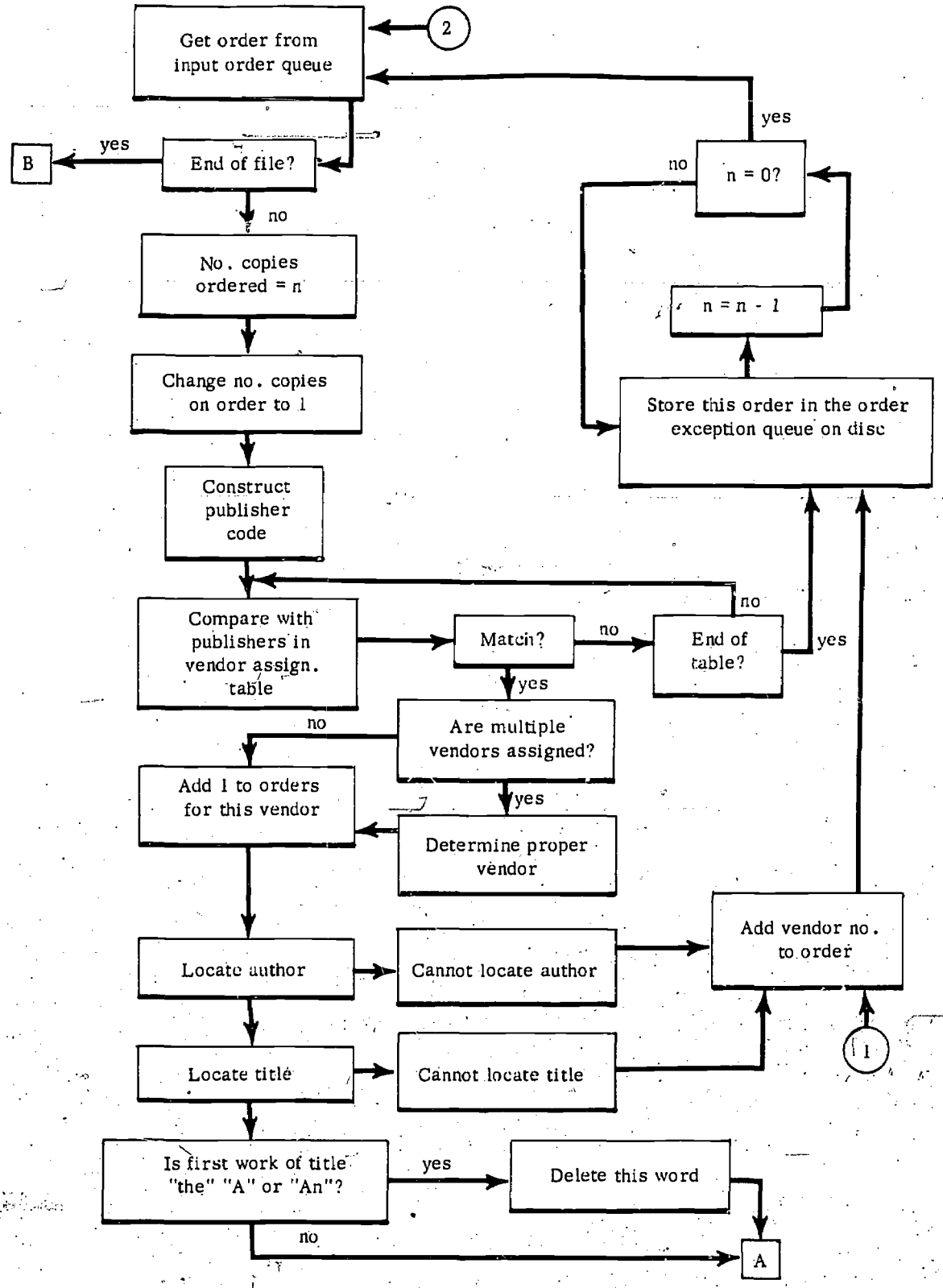


FIGURE C-1 ORDER PROGRAM

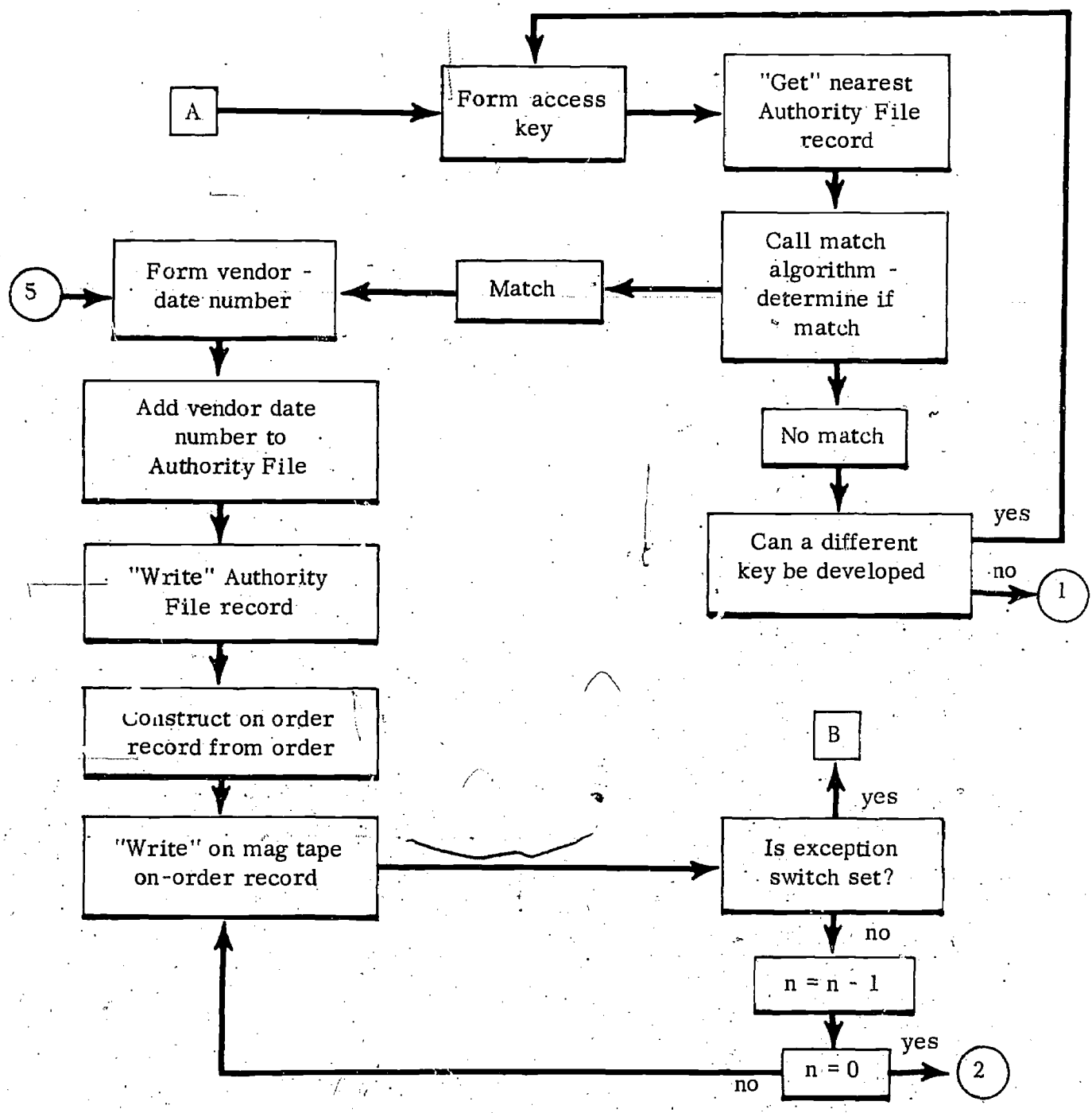


FIGURE C-1 (continued)

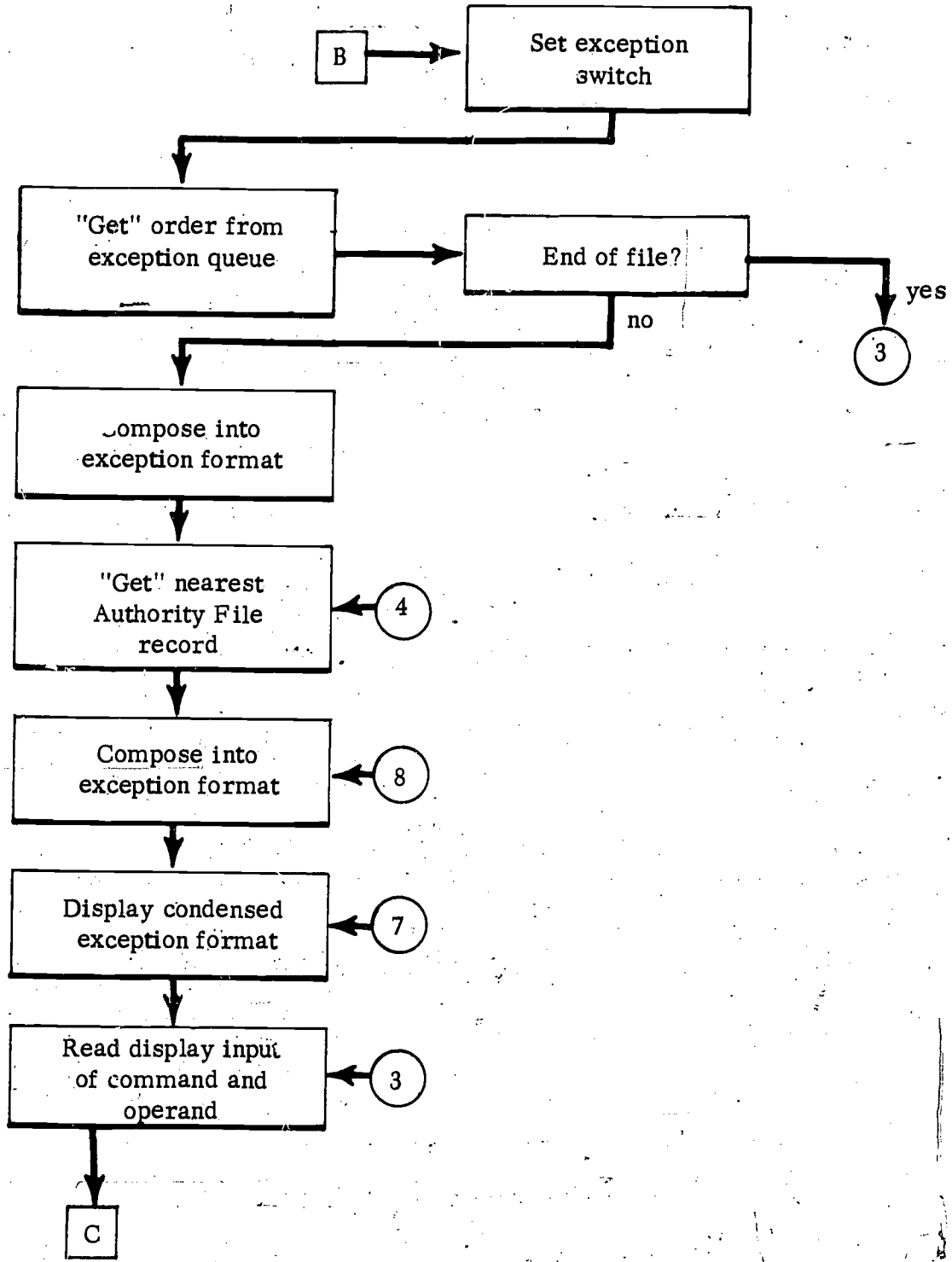


FIGURE C-1 (continued)

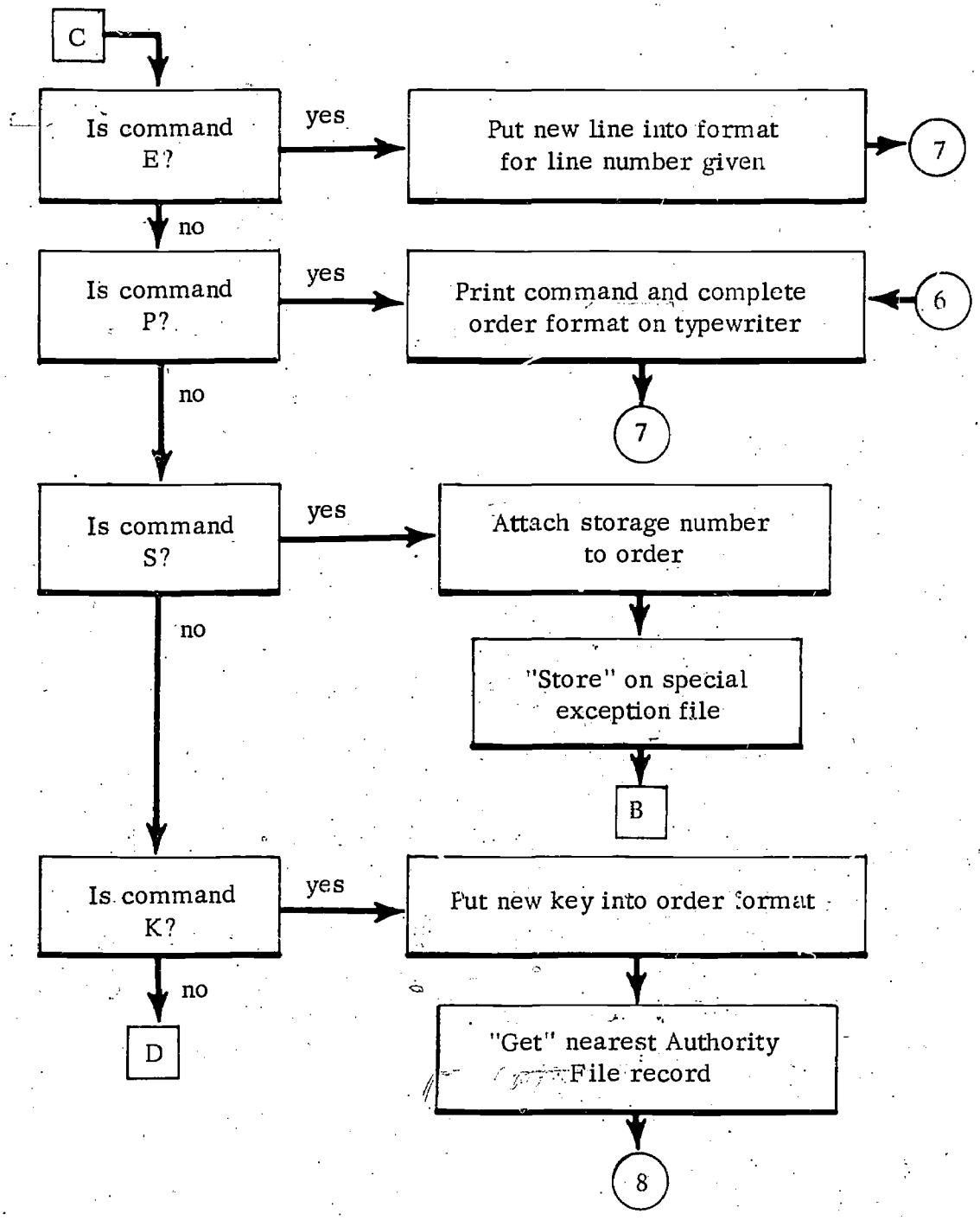


FIGURE C-1 (continued)

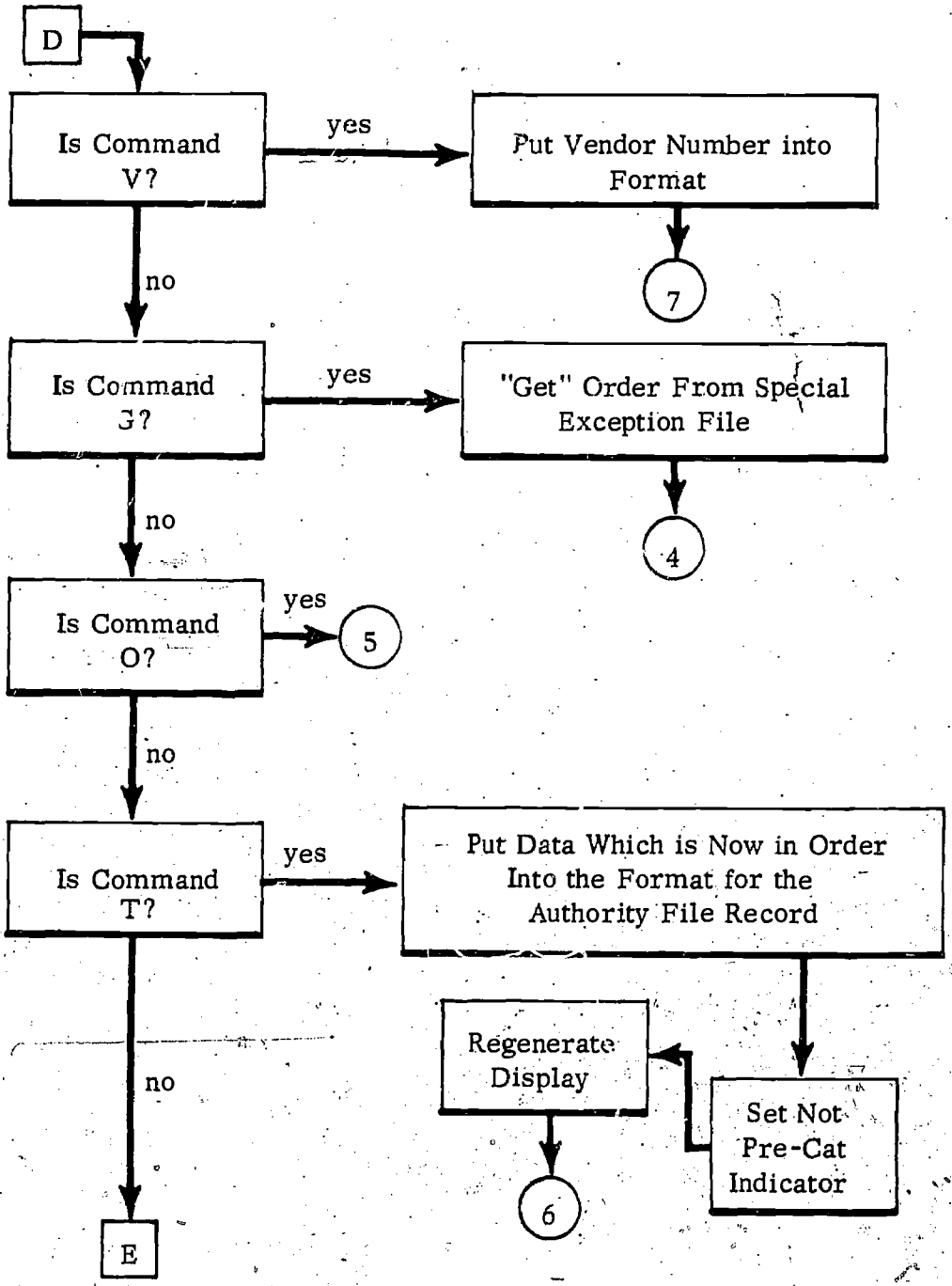


FIGURE C-1 (Continued)

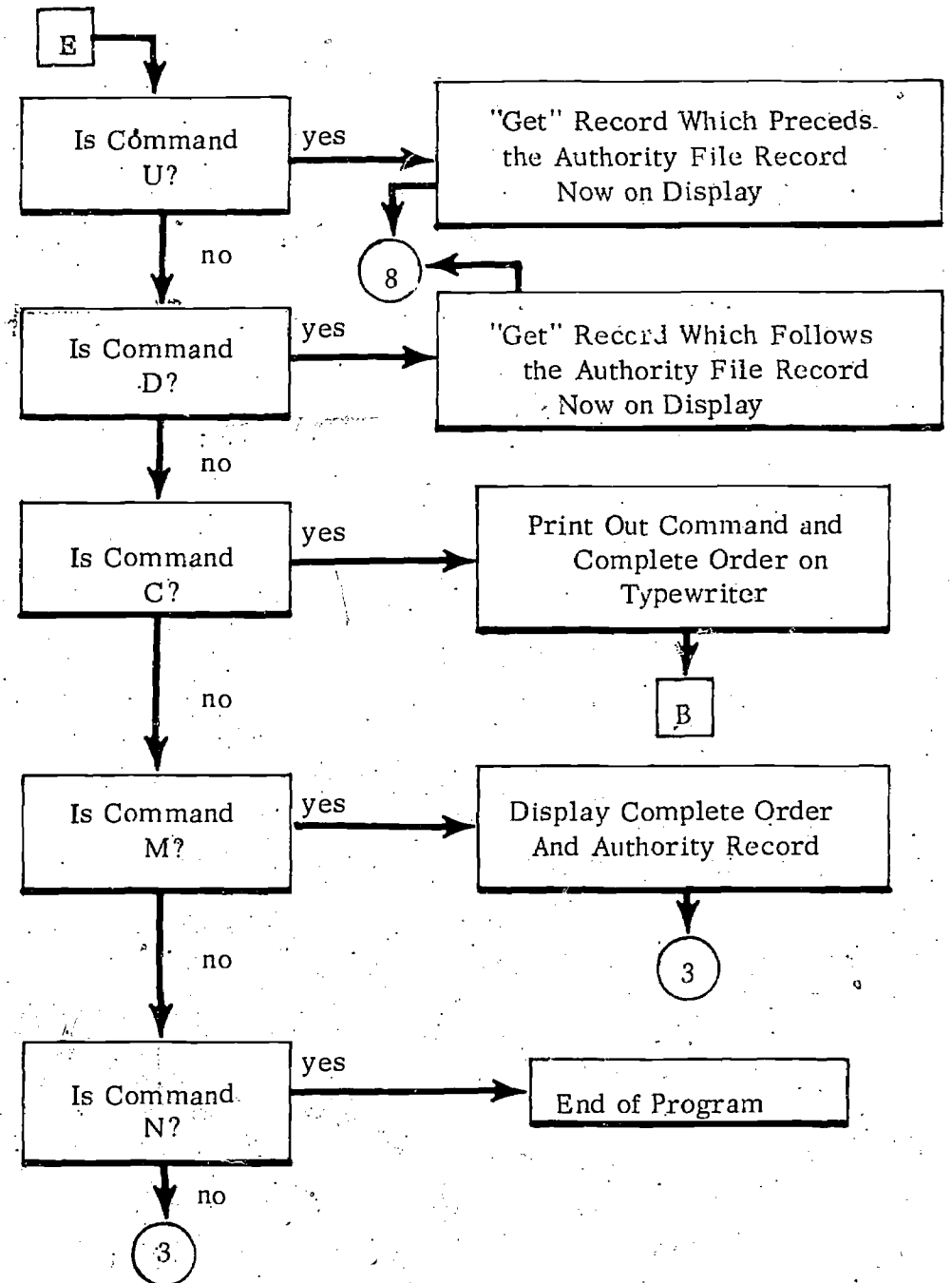


FIGURE C-1 (Continued)

If a multiple vendor entry exists in the vendor assignment table, the appropriate order assignment algorithm is used to assign the new order and processing proceeds as previously described.

Exception order processing is initiated from a display console by retrieving an order from the exception queue. This record is composed into a "condensed" exception format and stored in central memory. The nearest Authority File record corresponding to the author/title key is retrieved and also formatted. Both the order and Authority File records in condensed form are displayed as shown in Figure C-2. The console operator then enters an appropriate command via the display console. The command is processed to determine the next operation. The Exception Processing Commands are listed in Figure C-3. The appropriate action is taken as shown in the order program flow chart.

In order to correct any data on the order, a basic edit function is provided. Each line of the displayed order is numbered and, by entering the line number and new data for that line, the proper ordering information may be obtained. Exception orders do not have to be processed sequentially. The order may be temporarily stored under a code number provided by the operator, a hard copy of the order obtained, and the order may be recalled at a later time. The operator may also enter an author/title key and have the corresponding Authority File record, if any displayed. If the proper Authority record is not located, a temporary one may be created from the ordering data displayed. Vendor numbers may be assigned directly. If more data about the order is required, the use of one command will display the complete ordering data as shown in Figure C-4. The final action to be taken for each order is to process it as it appears on the display screen. For those orders which for any reason cannot be processed, a hard copy printout is obtained and the order erased from the computer memory.

A memory map of the order program is shown in Figure C-5.

For automatic processing, displays are not required so that neither the display input/output buffers nor the literal storage area are required. Order records are read from disc in blocks of ten records. Authority File records are read from disc after a search by author/title key. After processing the ten input records, the contents of the tape output buffer (ordering data) and the contents of the disc output buffer (exception records) are written.

For exception processing the input order record buffer is replaced by a display input buffer and, of course, an area for literals and a display output buffer are required. If the disc and tape output buffers are full or an "end of processing signal" (N) is generated from the console, the contents of these buffers are written.

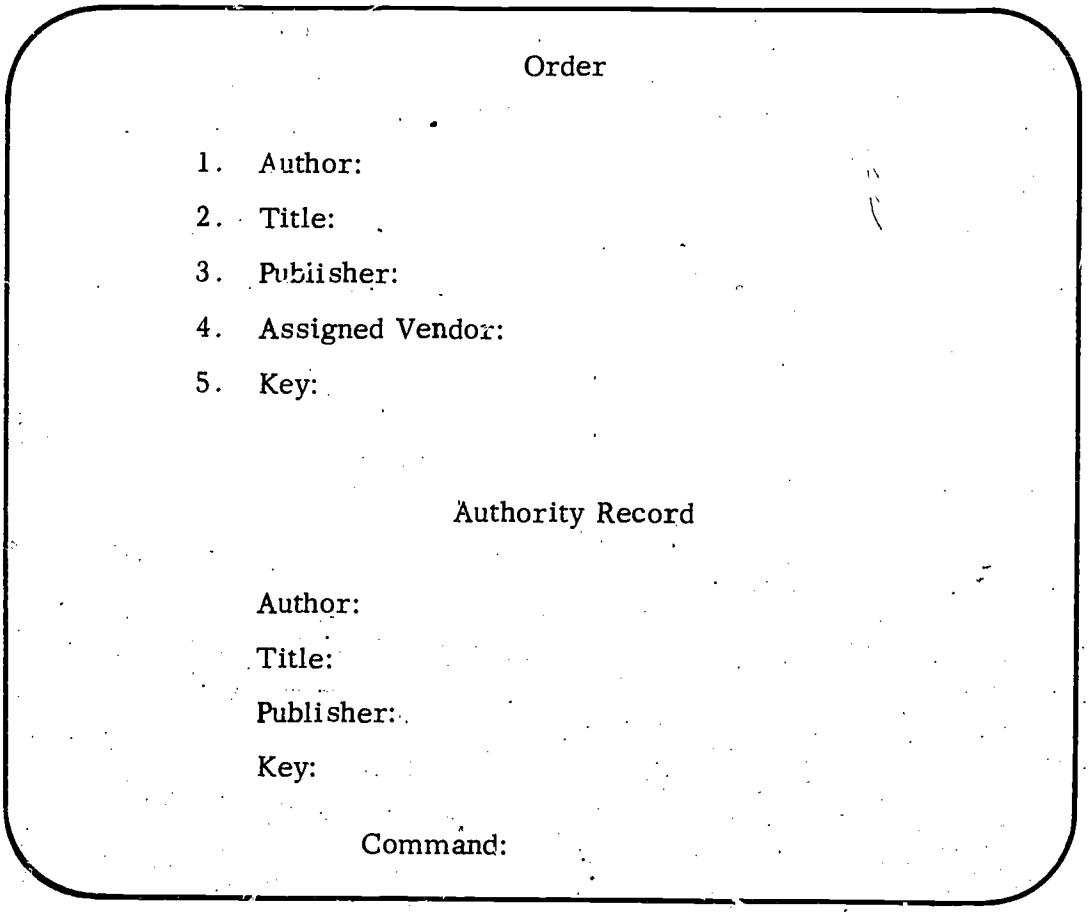


FIGURE C-2 CONDENSED EXCEPTION FORMAT FOR DISPLAY

EXCEPTION PROCESSING COMMANDS

Command	Operand	Function
E - EDIT	Line no. + new line	to change a line in order
P - PRINT		to obtain hard copy of order
S - SAVE	Storage number	to save order under storage number
K - KEY	7 letter key	to change order key and get a new Authority File record
V - VENDOR	Vendor number	to assign a vendor number
G - GET	Storage number	to retrieve order under storage no.
O - OK		to process order as per display
T - TEMPORARY		to create temporary Authority File record
U - UP		to get next sequential Authority record in file
D - DOWN		to get previous sequential Authority record in file
C - CANNOT PROCESS		to obtain hard copy of order and erase in memory
M - MORE		to display complete order and Authority record
N - END		to stop program

FIGURE C-3

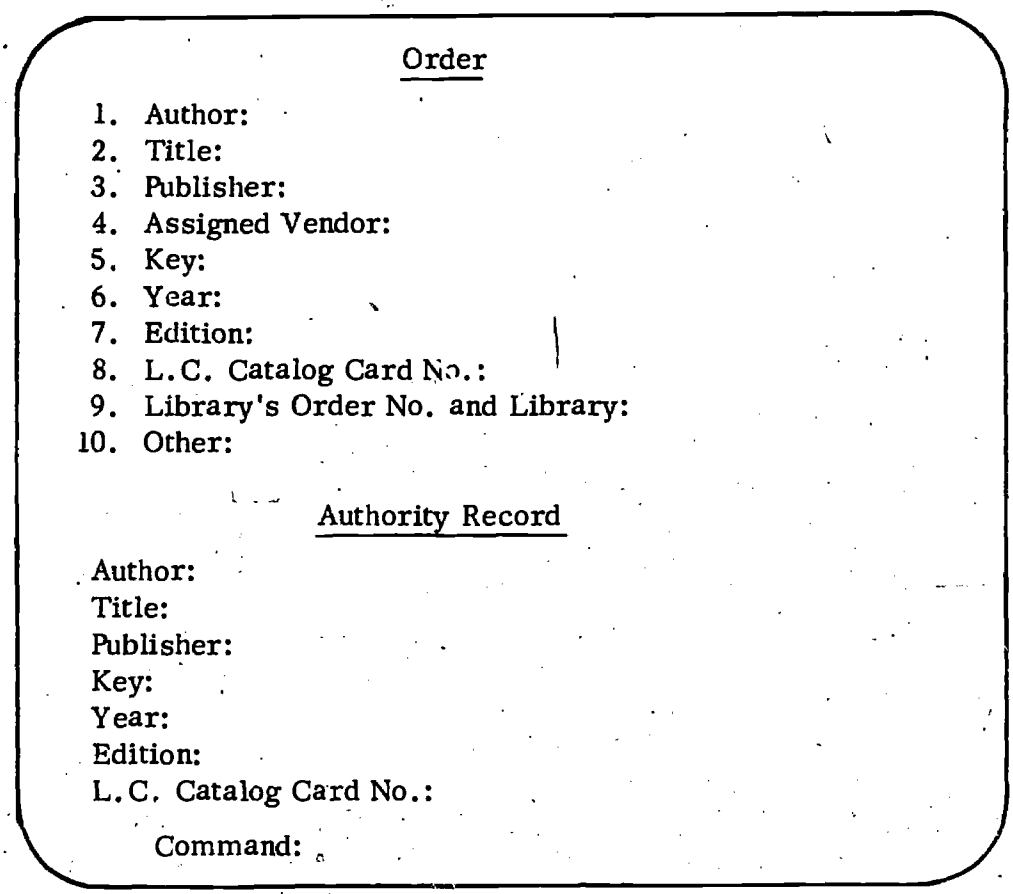


FIGURE C-4 COMPLETE EXCEPTION FORMAT FOR DISPLAY

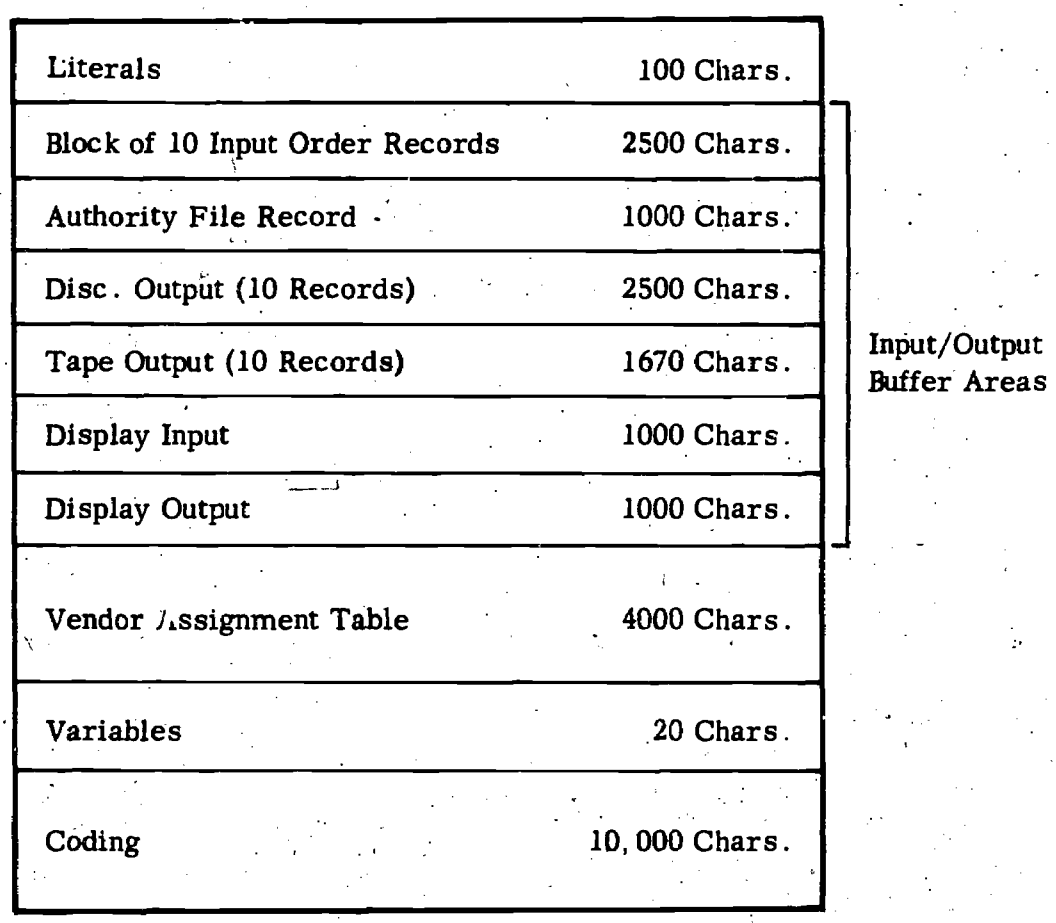


FIGURE C-5 ORDER PROGRAM MEMORY MAP

Since order processing is time-shared with other operations, a multi-programming operating system is needed. For multi-programming purposes, the order processing cycle requires a single partition of a maximum of about 13,000 characters. If more than one display console is used (which is likely as the system processing load increases) a partition per display would be required. Each partition would include storage for literals, ten input order records, an Authority File record, display buffers, disc buffers, tape buffers and variables. For non-re-entrant programming the complete memory map of Figure C-5 is required for each partition. If re-entrant programming is available, the vendor assignment table and coding would be shared between partitions.

RECEIVING PROGRAM

The flowchart of the receiving program for processing incoming books and/or invoices is shown in Figure C-6. It is begun by calling the status display format as illustrated in Figure C-7. The appropriate status number and vendor-date number is entered by means of the display keyboard and appears on the display screen as an entry in the "Command" line. After visually checking this command, it is submitted for computer processing by the operator pressing an "enter" key. The stored command is checked to determine if the status is "book with no vendor-date number" (status 3), and if so then the Authority File key format is displayed. The operator enters a key and the appropriate Authority File record is displayed on the vendor search format. These formats are illustrated in Figure C-9. The commands possible with the vendor search format are explained in Figure C-10.

If the vendor-date number is available (not status 3), the sequential on-order file on disc is searched by the given vendor-date number and a piece (consisting of the first twenty items of the appropriate vendor-date record) is transferred to central storage, and the input/output buffer for the requesting display station is cleared. The first five items in the piece are loaded into the display output buffer in condensed format and displayed as shown in Figure C-8. Each group of 5 items is referenced by the current value of an index. A number of commands as listed in Figure C-10 are available for processing. If the book which the operator wishes to process is on the display then the line number of that book is entered along with the price and discount if known. When the line number of the book has been entered and the status is "books and invoice" (status 1) the appropriate item of the output buffer record is checked to determine if price is included, and today's date is loaded into the appropriate display output buffer item and into the appropriate line of the central memory Authority File record piece.

For all cases in which a book is present (status 1,2,3), a check is made to determine if a previous receiving date exists in the on-order record. If this is the case an error routine displays "Item Already Received" to the console operator for appropriate action; otherwise normal

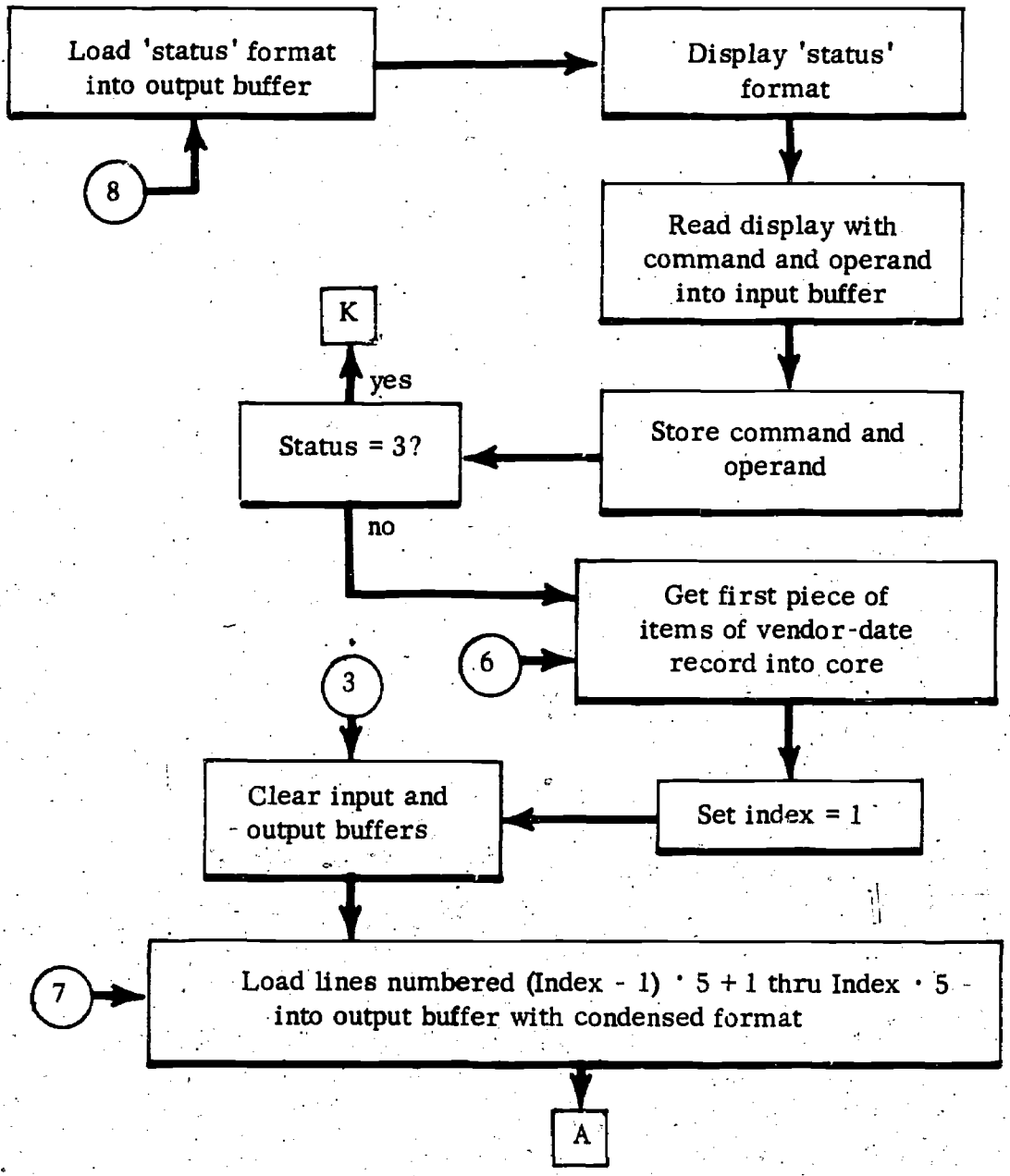


FIGURE C-6 RECEIVING PROGRAM

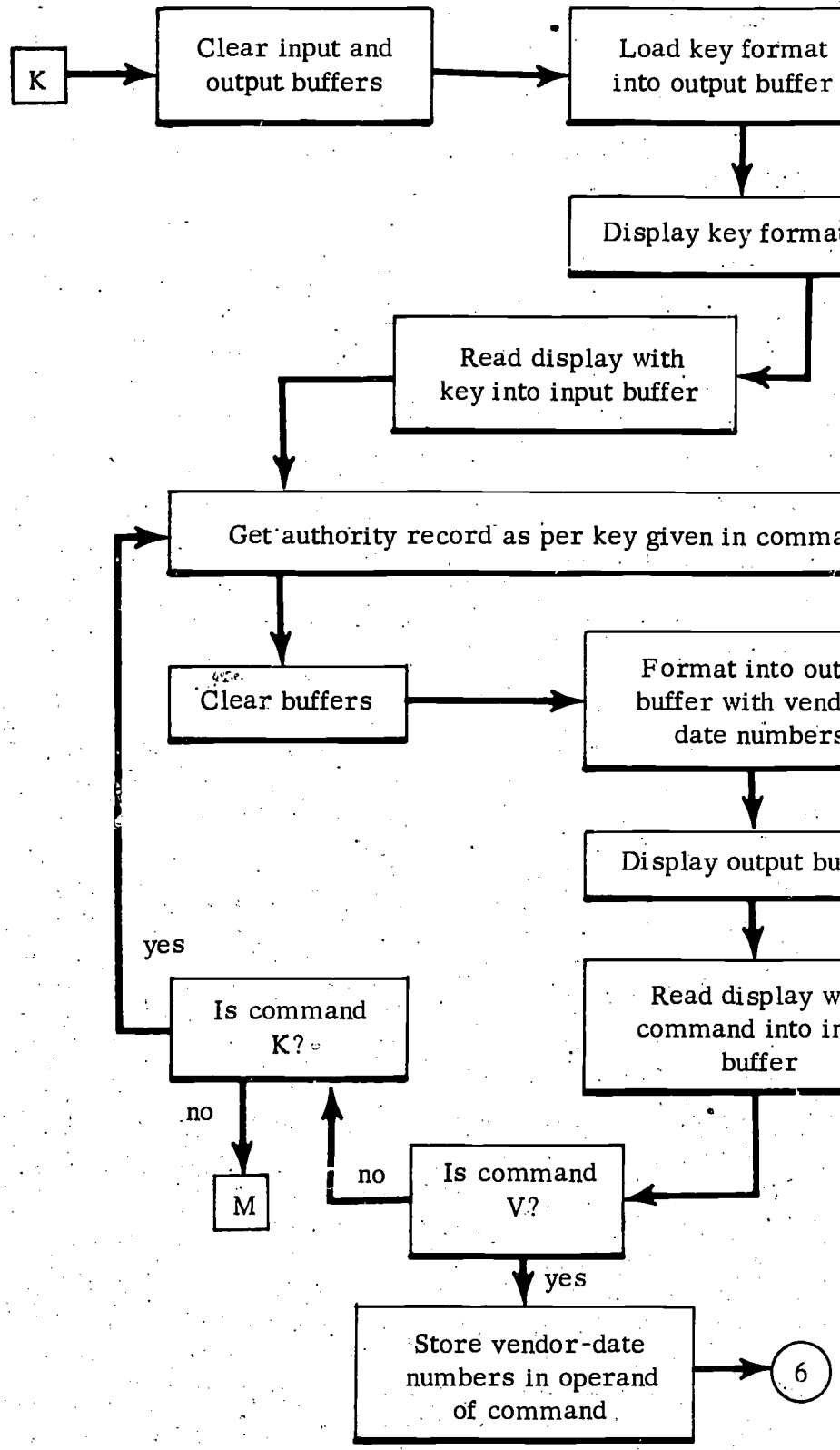


FIGURE C-6 (Continued)

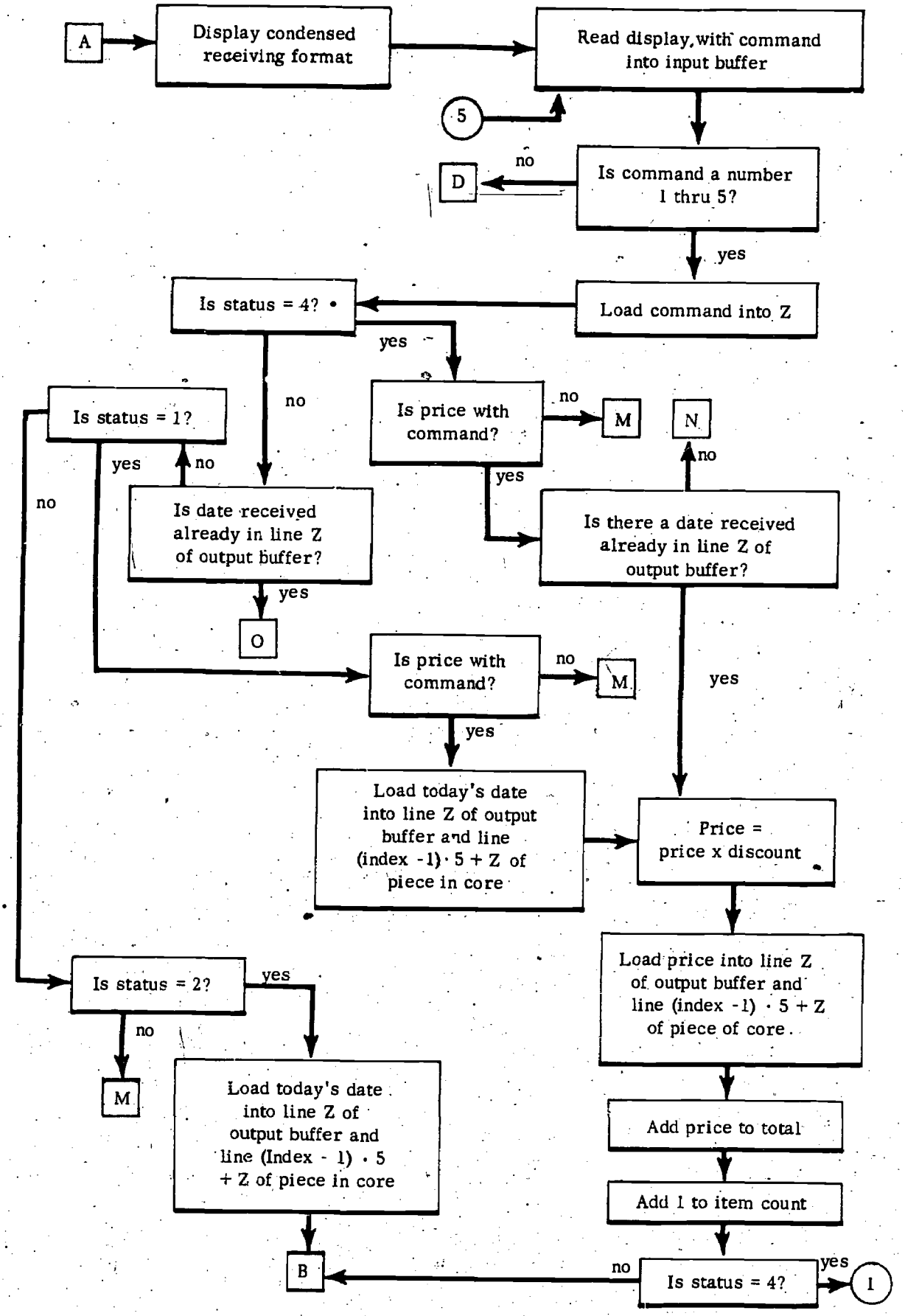


FIGURE C-6 (Continued)

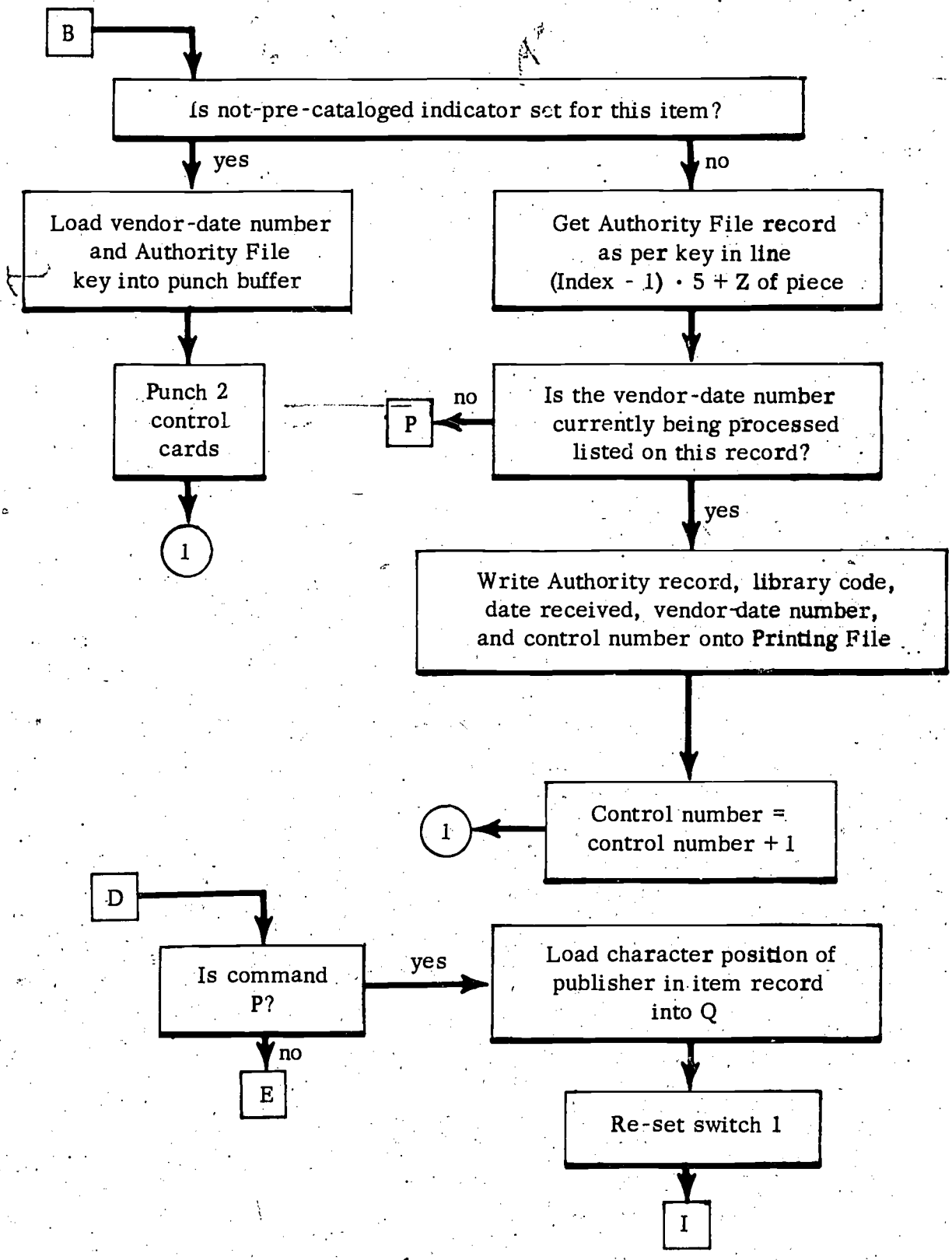


FIGURE C-6 (Continued)

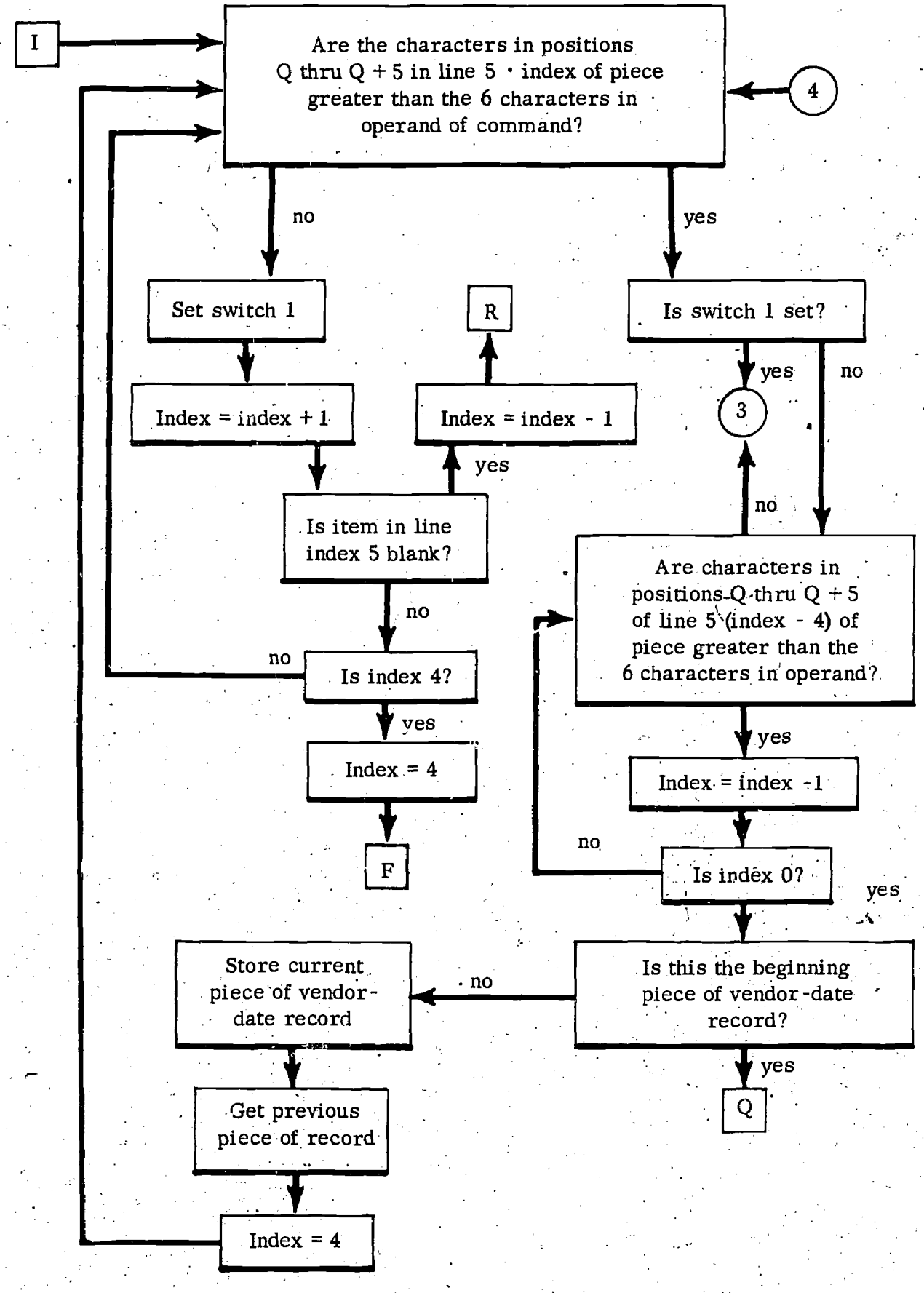


FIGURE C-6 (Continued)

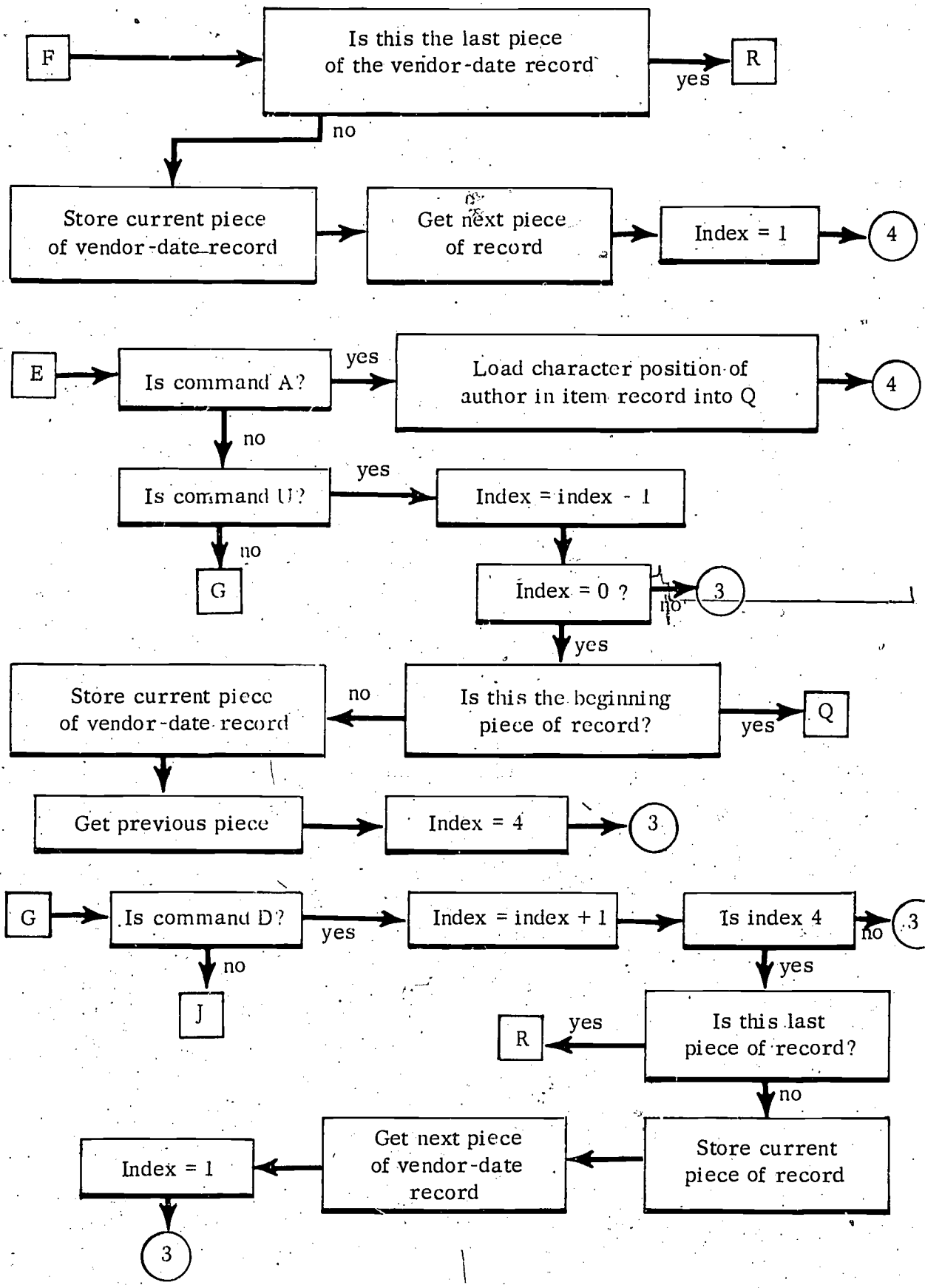


FIGURE C-6 (Continued)

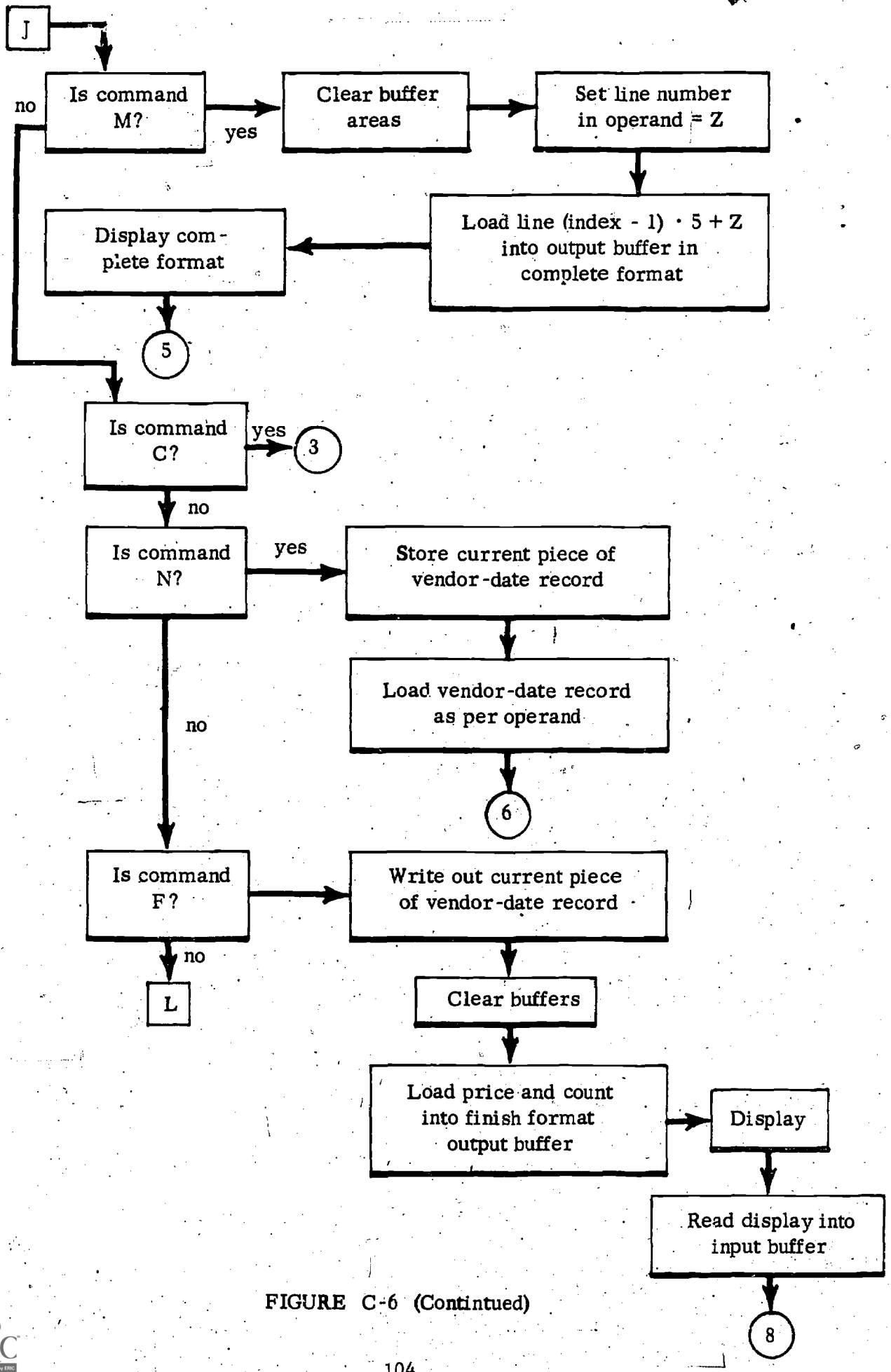


FIGURE C-6 (Contintued)

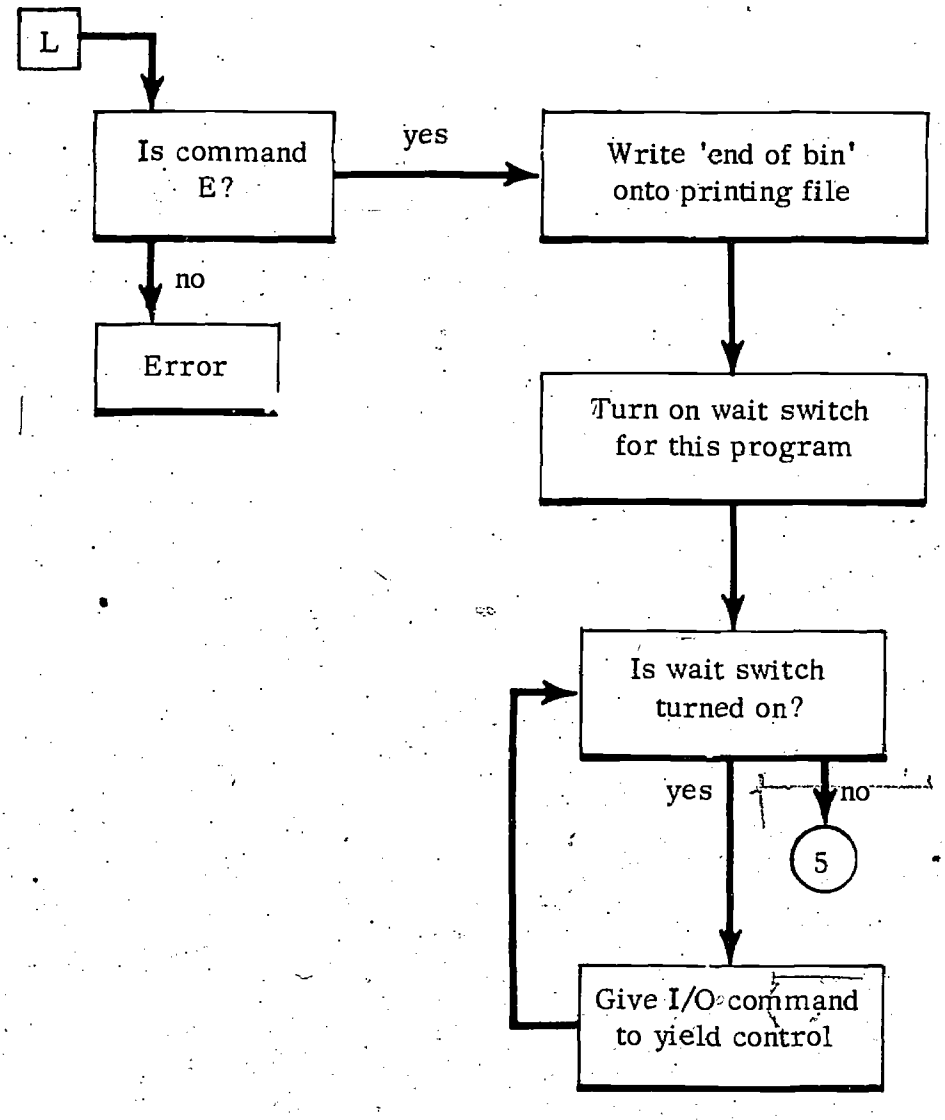


FIGURE C-6 (Continued)

ERROR ROUTINES

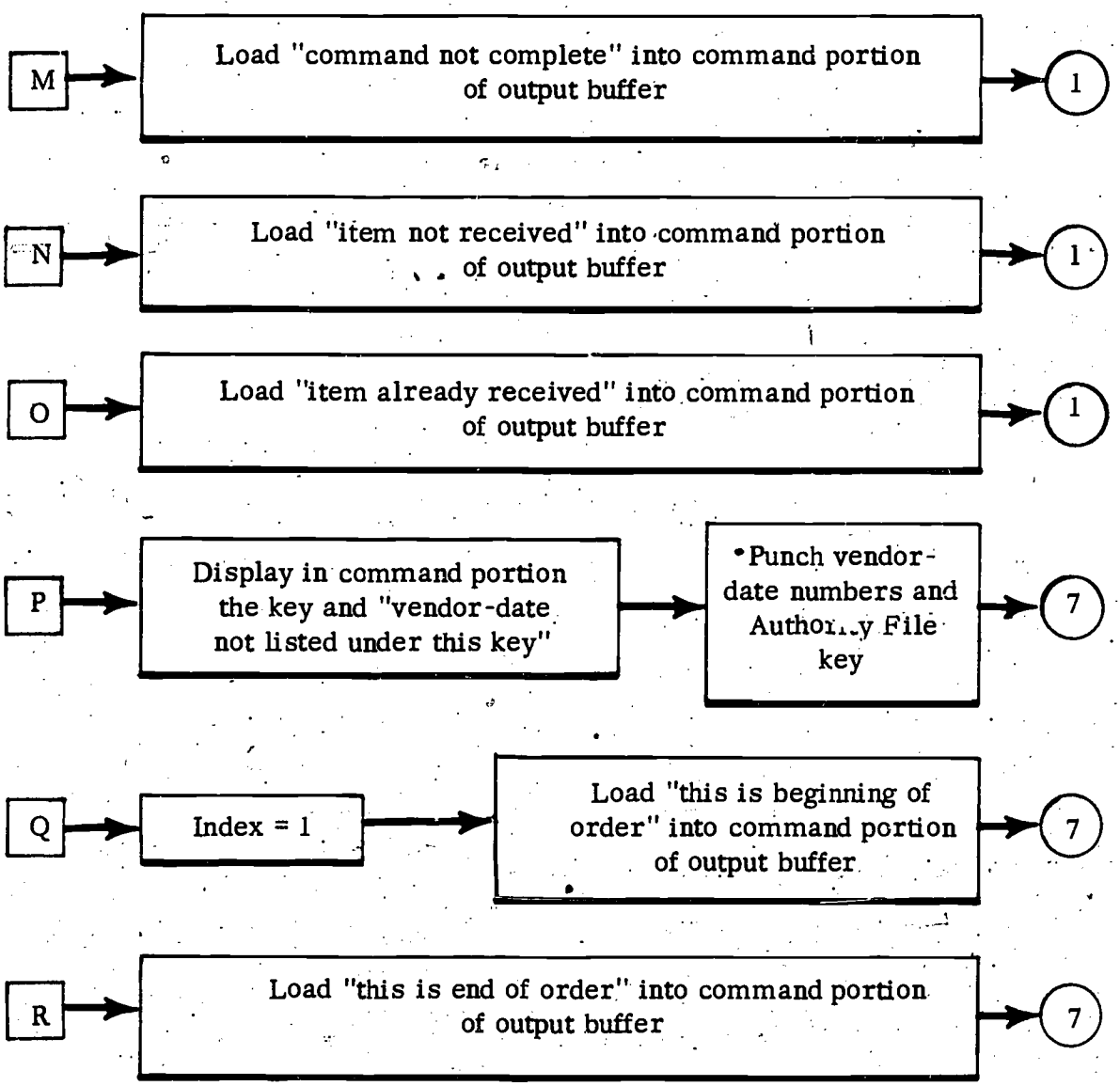


FIGURE C-6 (Continued)

1. Books and Invoice
2. Books and Vendor-Date Number
3. Books - No Vendor-Date Number
4. Invoice Only

Command: (Number and Vendor-Date)

FIGURE C-7 STATUS DISPLAY FORMAT

Vendor-Date Number: Pub. or Vend.

	Author	Title	Pub.	Date Rec'd.	Price	PreCat?
1						
2						
3						
4						
5						

Command:

FIGURE C-8 CONDENSED RECEIVING FORMAT

AUTHORITY FILE KEY FORMAT

Author/Title Code: (7 Letter Key)

VENDOR SEARCH FORMAT

Code:

Author: _____

Title: _____

Publisher: _____

Vendor date number:

_____ _____ _____

_____ _____ _____

_____ _____ _____

Command:

FIGURE C-9

Receiving Commands

Command	Operand	Function
1.	(price + discount)	to log in price and/or date of item in line number 1 currently displayed
2.	"	" of line number 2 .....
.		
.		
.		
x	"	" ETC .....
P	1st 6 chars of publisher	to locate item on-order record within a vendor-date record which is sorted by publisher
A	1st 6 chars of Author	"..which is sorted by author
U		to display previous 5 items
D		to display next 5 items
M	line number	to display complete data of item record currently in line number given on display
C		to return to condensed format
N	vendor date record	to get new vendor date record to be processed in this same receiving shipment or invoice
E		to indicate end of Bin
F		to end processing of this receiving shipment or Invoice.

Vendor Date Search Commands

V	vendor date number	to begin processing with found vendor date number
K	7 letter access key	to display another Authority record with this key

FIGURE C-10

processing continues. Net price is calculated and stored in the appropriate line of the display output buffer and the central memory Authority File record piece. The net price is added to a total running price. If the pre-cataloged indicator is not set, the Authority File record for this item is retrieved. A check to determine if the current vendor-date number is present in the Authority File record is made. If it is, the Authority File record, library code, date received, vendor-date number, and control number is written on the printing file queue.

If the pre-cataloged indicator is set, then the vendor-date number and Authority File key are loaded into the punch buffer; two control cards are punched and the books and control cards are routed to the Cataloging Department.

If upon accessing the Authority File record no vendor-date number correspondence is found, then an indication of this fact is displayed and a punched card containing the vendor-date number and Authority File key for the books is generated. The book with punched card is routed to the Cataloging Department for further processing.

For invoice processing (status 4), the input command is checked for price and the output buffer for date received. If both are present, the price is entered into the record. No printing file record is required.

If the book being processed is not in the first five items being displayed from the core resident piece of the on-order file, a search for the correct book is necessary. This is accomplished by displaying appropriate sections of the vendor-date record to the console operator and progressing through this record under operator control.

If another group of 5 items is required, the console operator enters either the command P together with the first six characters of the publisher, or A with the first six characters of the author depending upon whether the vendor-date number corresponds to a vendor or publisher. If the console command is a publisher indication with key, this key is compared to the publisher of the last item of the group of 5 items being displayed. If the publisher is less than the command key, the same check is performed on the first item of this group. If the publisher key is still smaller than this record entry, the index is decremented such that the next previous group of five items is examined to determine if the first item is greater than the key. Upon identification of the correct group, the group is displayed and processing proceeds. Since the on-order record buffer (a piece) in central memory can store a maximum of twenty items (four groups), for longer records only a portion of the file will be in core at a given stage of processing. If the search described above is not successful, the index for referencing core resident groups will eventually set to 0. Upon sensing this condition, the piece is tested to determine if it is the beginning of the vendor-date record. If it is, a "beginning of order" indication is displayed to the console operator. The operator can then determine that this item is not in the on-order file.

If the condition does not correspond to the beginning of the record, the core resident piece is written, and the next set of twenty items preceding the set processed are transferred from the on-order file to central memory. The last item of the last group is then tested to determine if it is greater than the key. If it is, the cycle previously described is executed. Searching the on-order groups in ascending order results if the publisher is greater than the publisher key of the item required. For this case the index is incremented so that the last item of succeeding groups is tested. The four groups resident in core are searched in this manner. If a hit does not result, a determination of whether this piece is the last of the vendor-date record is made. If the last piece has less than four groups, a blank code will be present as the fifth item of each blank-group. If this is the case, an "end of order" indication is displayed for appropriate operator action. If not, the resident piece is written and the next succeeding piece (four groups) are transferred to the central on-order record buffer. File searching is repeated beginning with the last item of the first group.

The operator may also request the next or previous group of 5 items to be displayed. The complete data for a single item may be requested and results in the format shown in Figure C-11.

When an "end of bin" command is given, processing halts until the printing file program has indicated that all printing is complete. Finally, the finish command results in the total number of items processed and the total price displayed as shown in Figure C-12.

Error routines working in conjunction with the console display, will indicate: 1. incomplete operator commands entered via display console; 2. book has not been received when processing an invoice only; 3. a copy of book being processed has already been received; 4. vendor-date number not listed in Authority File record when cross checking against on-order file record.

The Receiving Cycle processing is implemented with four display console stations for incoming book and/or invoice handling and two stations each consisting of a line printer, printing card punch, serial printer and card cutter. These are used for printing catalog cards, and labels and punching control cards. A single printing card punch is also shared between the four display stations for generating control cards for the cataloging or business departments.

A memory map for the receiving program is shown in Figure C-13. This corresponds to one of four partitions; each partition servicing one display station.

For the receiving program a piece of twenty items of four groups of five items each are input from the disc on-order file to a central memory buffer per on-order file access. Each display console thus has twenty records available in its buffer for book processing. A single Authority

Total Number of Items Processed:

Total Price:

FIGURE C-12 FINISH FORMAT

Vendor-Date Number: Pub. or Vend.

Author:

Title:

Publisher:

Date:

Edition:

Library Code:

Key:

Lib. Order Number:

Date Received:

Price:

Shipped Date:

Claim Date:

Charge:

Pre-Cataloged?

FIGURE C-11 COMPLETE FORMAT

(One of Four Partitions)

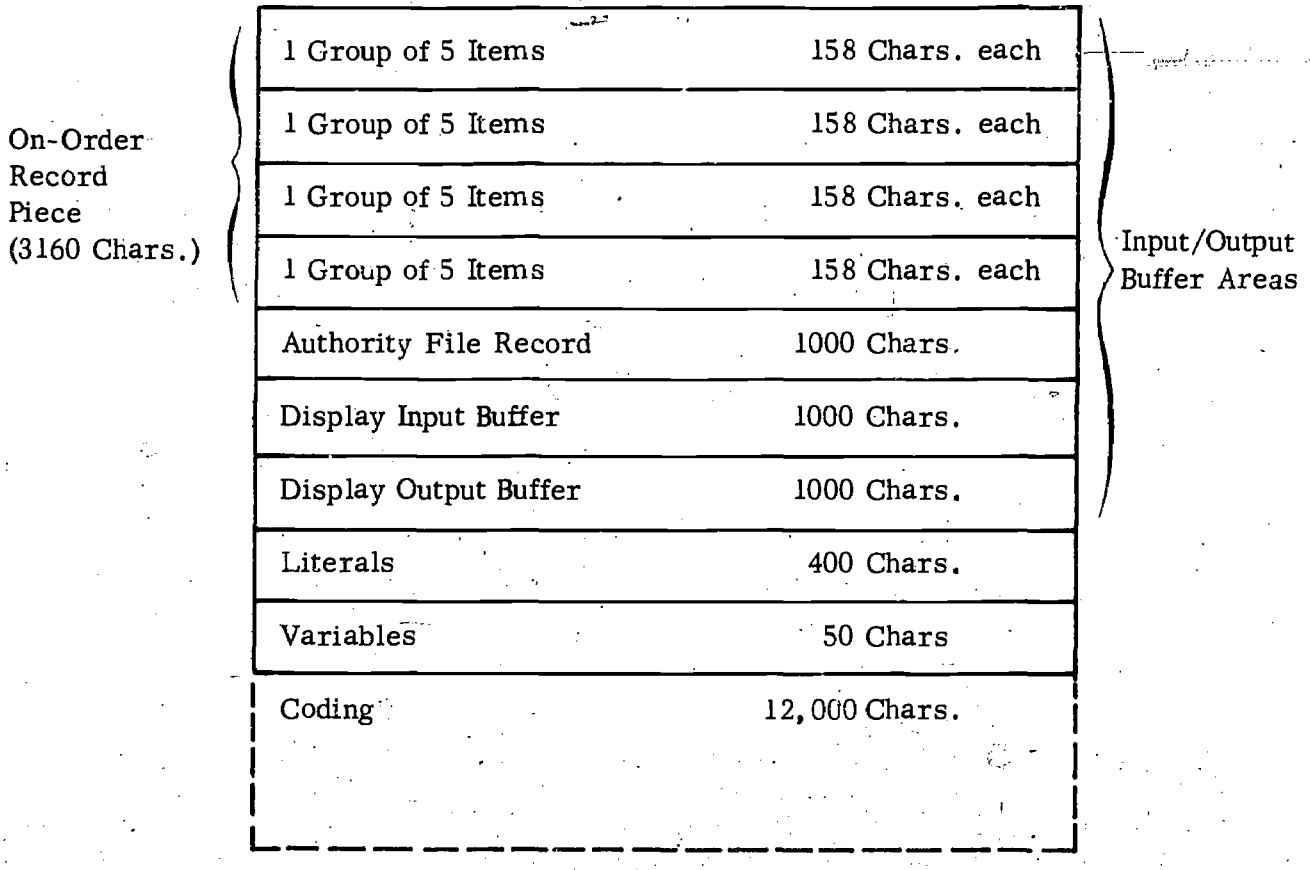


FIGURE C-13 RECEIVING PROGRAM MEMORY MAP

File record buffer area is required. The maximum record size of 1000 characters establishes the size of this buffer. Display buffers are also of 1000 character capacity since a typical display has provisions for 1000 character positions. The remaining storage areas for literals and variables also follow from previous descriptions. The program coding area is shown dotted to indicate that this space will be necessary on a per-partition basis if re-entrant programming is not used. If re-entrant programming is available a single program coding area would be shared between all four partitions. Our estimates assume non-re-entrant programming.

PRINTING FILE PROGRAM

As noted in the description of the receiving program, an output record consisting of an Authority File record and plus control data is transferred to a printing file. The printing file program formats this data and prints catalog cards and labels, and punches control cards for each volume received. Since we wished to have this operation concurrent with the receiving function, rather than forcing the receiving console operator to wait for the printing to be completed for each book, the printing itself must be controlled by a different partition than the receiving program itself.

We have assumed that each receiving console operator will average one book every 30 seconds. One of the main objectives is to keep the catalog card line printers busy. A single book will generate on the average 8 catalog cards (title, two authors, three subjects, shelf list, and one added entry such as a series card) and we estimated that each card requires an effective number of 17 lines of print (including spaces). With a printing rate of 300 lines per minute (due to an extended character print chain) and printing cards two-up, a single line printer will print cards for about 4 books in a minute. We have planned for the output of 2 receiving programs to be written on a single printing file which will control one line printer.

Other requirements have been based on the line printing speed. Three labels requiring a total of about 100 characters on 2 lines will be printed on a serial printer or typewriter. A serial keypunching machine is needed for punching control cards.

At a peak rate of 3000 books received a day, we require 4 receiving programs and two printing file programs. The printing file program will process cards and labels until an end-of-line indication is given by both operators of the receiving consoles. Until the printing file is emptied, the receiving programs may not continue. This scheme allows maximum flexibility with regard to changes in either receiving speeds or printing speeds.

A flow chart of the printing file program is given in Figure C-14 with a memory map shown in Figure C-15.

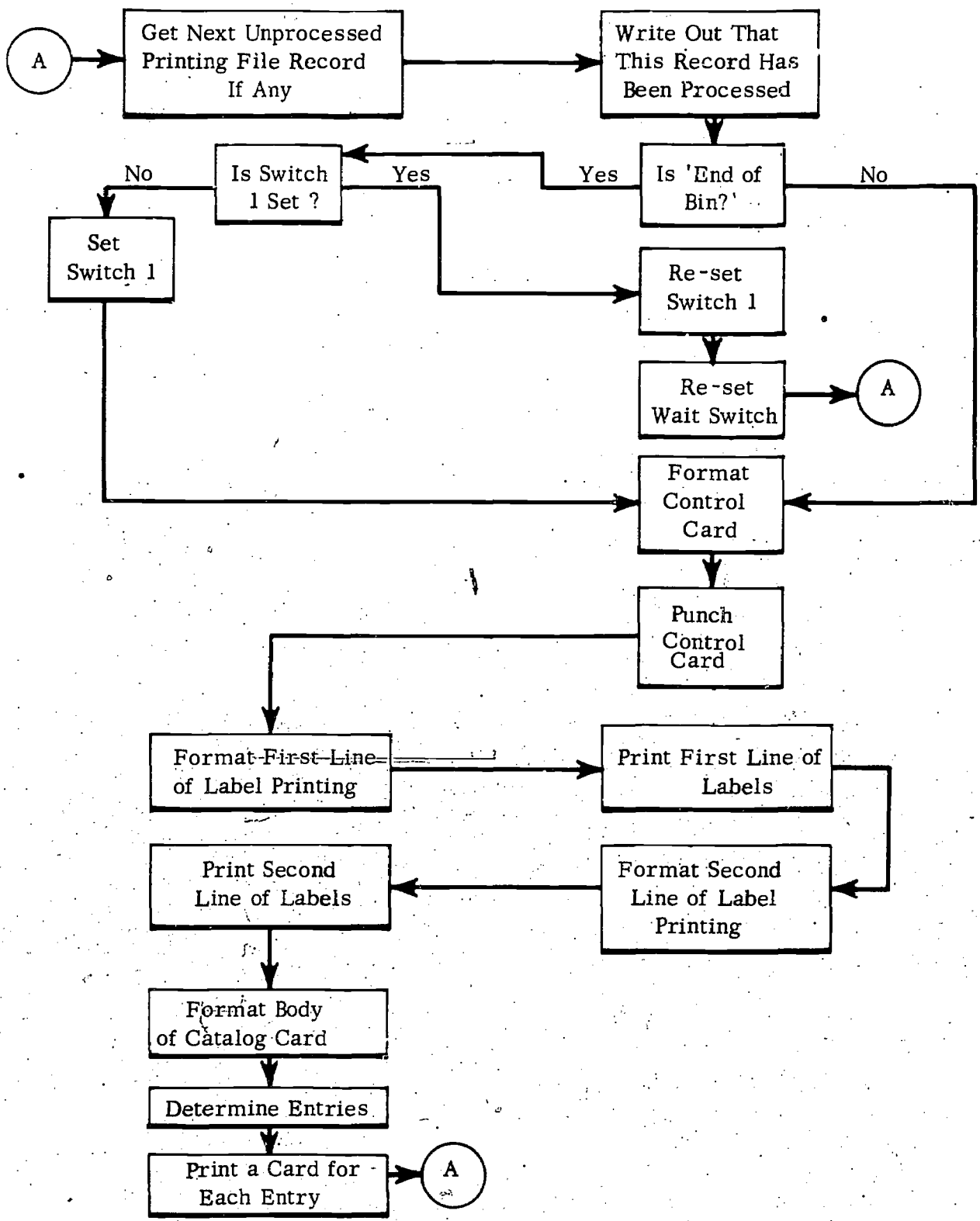


FIGURE C-14 PRINTING FILE-PROGRAM

MEMORY MAP

(One of Two Partitions)

Printing File Record	1,000 Chars.
Control Card Record	80 Chars.
Label Line	120 Chars.
Catalog Card Line	120 Chars.
Variables	50 Chars.
Coding	6,000 Chars.

Input/Output Buffer Areas

FIGURE C-15 PRINTING FILE PROGRAM

SHIPPING PROGRAM

The Shipping Department will require a packing slip for each shipment of books. The packing slip is obtained by delivering the punched control cards to the computer room. The cards are read into the card reader as input to the shipping program outlined in Figure C-16.

The vendor-date record for each card is obtained from the on-order file. The item within the vendor-date record is identified by the control number which is also on the card. The date is entered on the item record and a single print line containing an abbreviated author and title, the vendor-date number, and the ordering library's purchase number is generated. This print line may go onto a magnetic tape for sorting, or if no sorting is required, it may be printed on a packing slip directly.

A memory map of the shipping program is shown in Figure C-17.

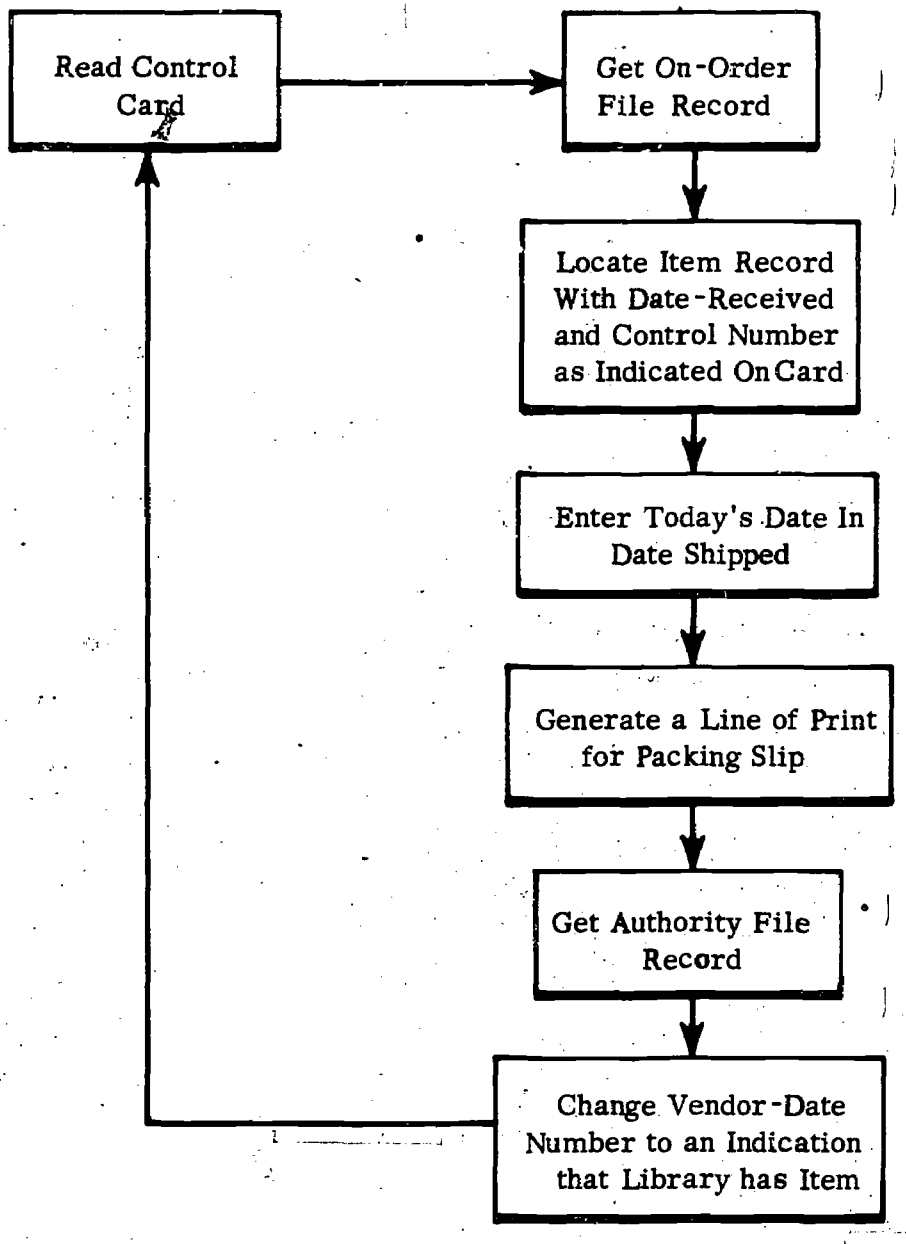


FIGURE C-16 SHIPPING PROGRAM

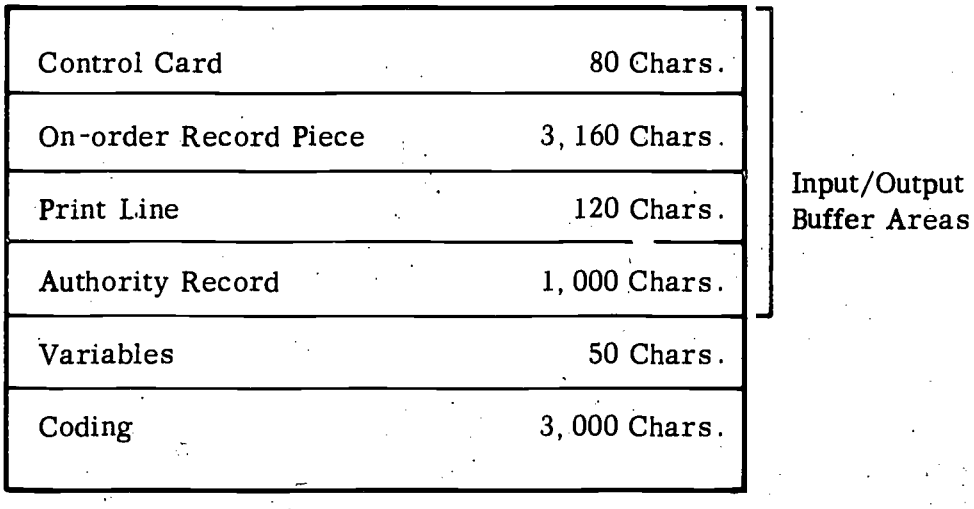


FIGURE C-17 SHIPPING PROGRAM MEMORY MAP

DISTRIBUTION OF CHARGES AND ORDER CANCELLATION PROGRAM

The flowchart for this program is shown in Figure C-18. It will be run once a week in a batch processing mode.

COST ESTIMATES

Based upon the flowcharts and descriptions of programs presented here and elsewhere we have estimated programming costs. We have based our estimates on the use of a combination of assembly and higher order programming languages being used. We feel that while much of the programming can be done in a higher level language, certain routines should take advantage of the efficiencies and capabilities of an assembly language. Our estimates of the instructions required for each program are given in the table below:

Program	Assembly Language Instructions	Higher-Language Instructions
Order	600	800
Receiving	600	1,000
Printing File	500	500
Shipping	100	300
Distribution and Claim	100	600
Catalog Update	200	800
Other (file maintenance, testing, etc.)	1,000	2,000
	3,100	6,000

We estimate the Phase II programming costs to be approximately $160,000, including computer time for testing.

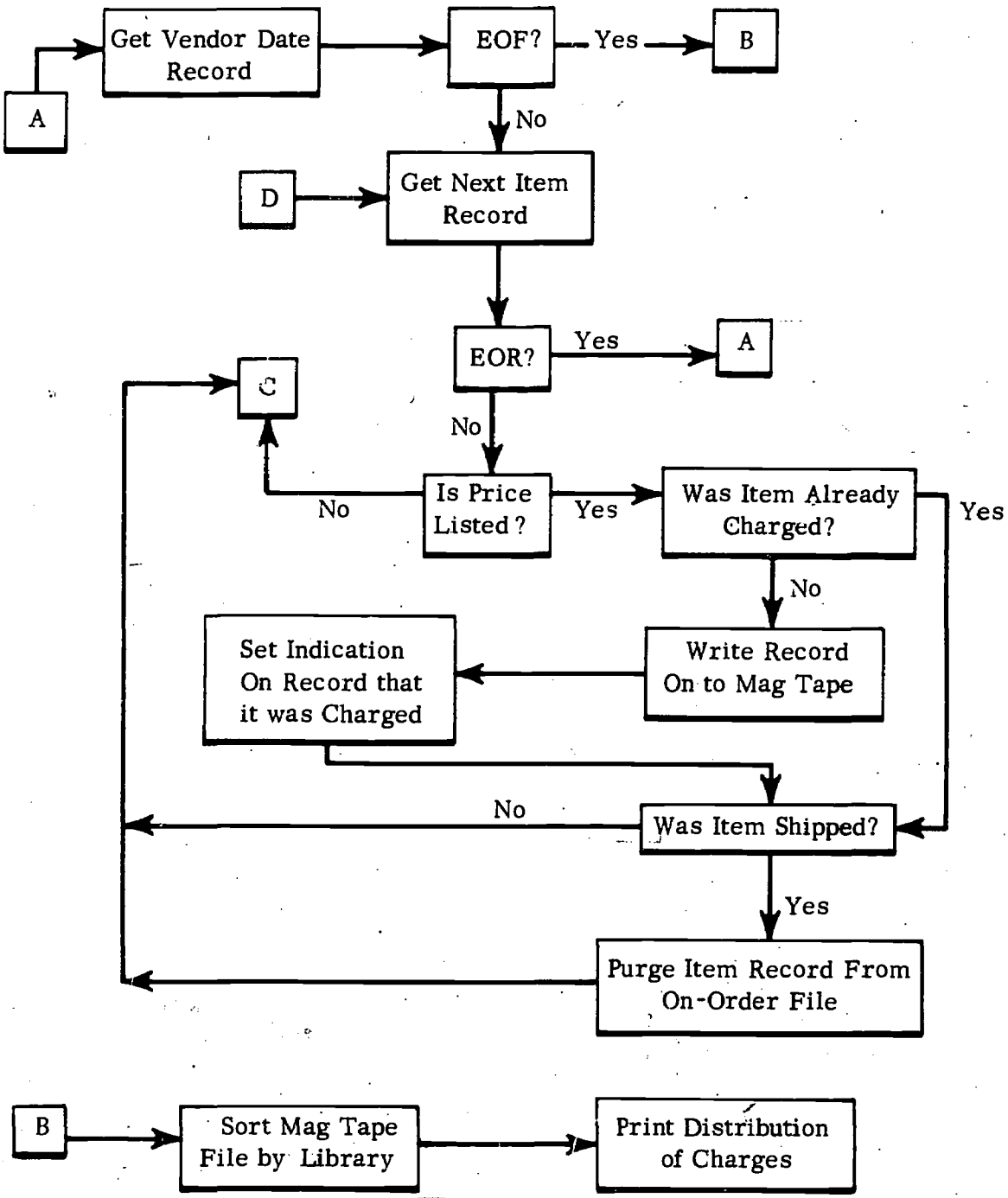
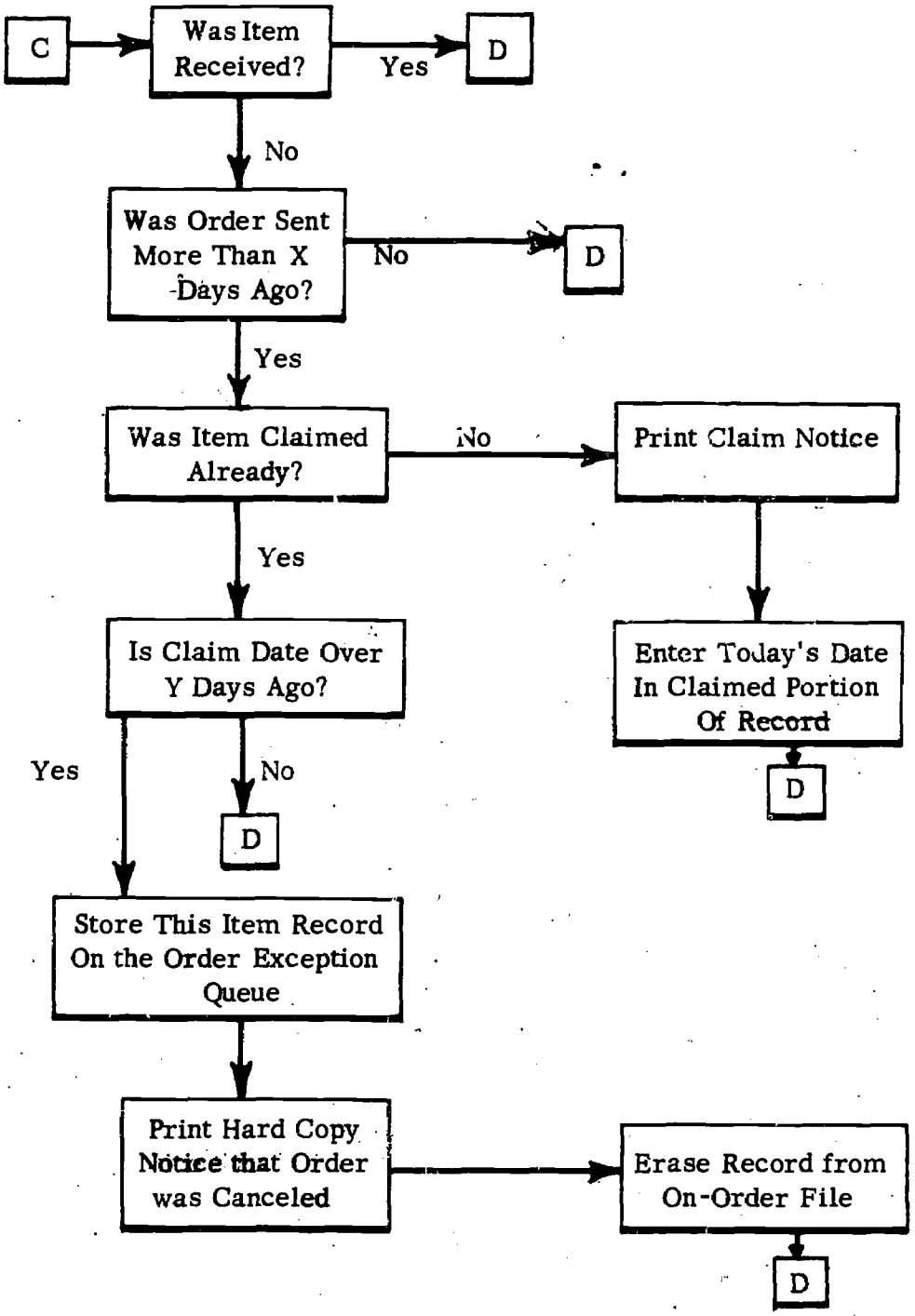


FIGURE C-18 DISTRIBUTION OF CHARGES AND ORDER CANCELLATION



- FIGURE C-18 (Continued)

APPENDIX D

COMPUTER HARDWARE

CENTRAL PROCESSING UNIT

The central processing unit should have all hardware features to support a multi-programming operating system, including memory protection for at least eight core resident partitions. It should have at least three selector channels including one multiplexor channel with transfer rates in the range of 250,000 to 500,000 characters per second.

The central processor should have a 2 to 3 microsecond cycle time. Processing rates for this system will be established by input/output transfer rates and operating system overhead rather than central processor speed. To establish the required operating rate of the central processor, input/output rates must first be estimated. For the highest transfer rate condition we assumed the Authority File disc, on-order file disc, one display unit, a line printer, a typewriter and a card punch are simultaneously transferring data. The total rate of transfer for this complement is estimated at 400 to 600,000 characters per second. For a four character computer word a two microsecond cycle time memory has a data transfer rate of 2,000,000 characters per second. Thus, a fifth to a third of the available central processor time will be used for data transfers. Our estimates are that data transfers are predominantly from the Authority File (at a rate of approximately 300,000 characters/second) and the on-order file (at a rate of approximately 150,000 characters/second). The following assumptions appear conservative for estimating the computing load:

1. For the Authority File, 10% of the data requires processing;
2. For the on-order file, 20% of the data requires processing;
3. Twenty memory accesses are required per word processed.

This corresponds to 300,000 words per second for central processor average computing rate. Note that for the worst case, two-thirds of the available central processor time is available for non-I/O operations; for a two microsecond memory cycle time this corresponds to 334,000 words per second processing rate. These estimates establish that a 2 to 3 microsecond processing rate is adequate for this application.

The operating system should support multi-programming to the degree required, and control all input/output functions including the manipulation of indicies for random access storage devices. In addition, the operating system must support the polling function for communication lines.

In estimating central memory requirements we have used the following figures for programs which must be resident in core simultaneously:

Operating system	40,000	characters
Order program	24,000	"
(4) Receiving programs at 25,000 each	100,000	"
(2) Printing file programs at 7,000 each	14,000	"
Shipping program	10,000	"
	188,000	characters

These figures are based on non-re-entrant programming - each program resides independently in its own memory protected partition in core. To include the proper safety factor, we recommend a central memory capacity of 256,000 characters. The computer should be upward compatible in both speed and memory capacity.

PERIPHERAL EQUIPMENT

The Authority File will require a random access device capable of storing 200 million characters. This is required for the initial Phase II configuration. The storage unit or units should have a maximum capacity of over 500 million characters and may be of the fixed or removable disc pack variety. The unit or units should have a maximum access time (including latency) of 200 milliseconds.

Other files will require random access devices with an initial capacity for 10 million characters, and access times of 150 milliseconds or better.

Three tape drives with 30,000 character per second transfer rates are required. Three line printers with effective printing rates of 300 lines per minute using an extended character set are needed for Phase II. Serial printers or typewriters should have 15 character per second printing rates. Three of these devices are required. Also, three on-line printing card punches with 10 cards per minute punching rates will be needed.

Display units should be alphanumeric with keyboards. Each unit should have its own internal buffering control, and have 1,000 character display screens.

Finally, a card reader with a minimum speed of 300 cards per minute is required.

The configuration is illustrated in Figure D-1.

COST ESTIMATE

Our cost estimate for a computer configuration as outlined above is $30,000 per month.

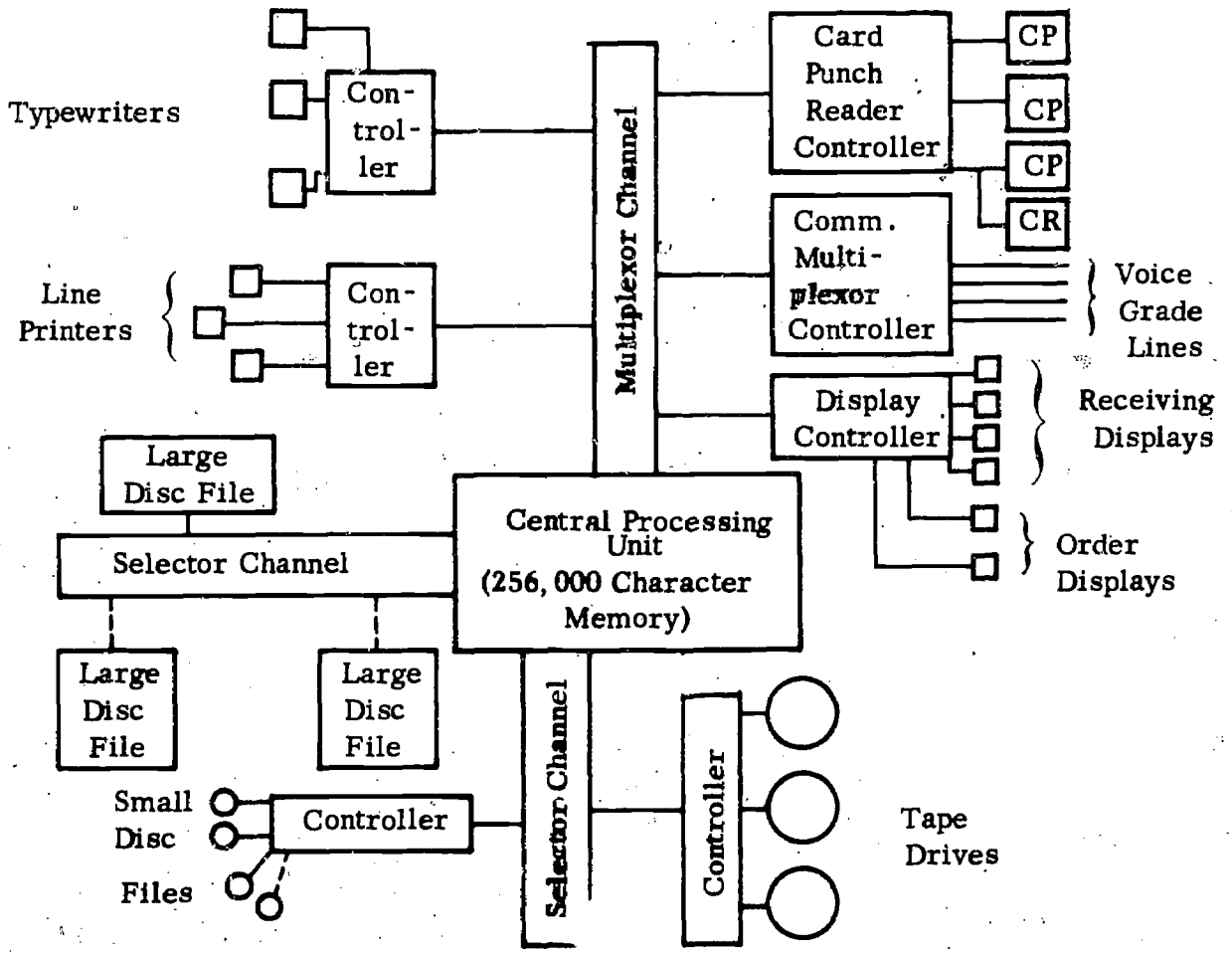


FIGURE D-1 DATA PROCESSING CONFIGURATION

APPENDIX E

COMMUNICATION NETWORK AND TERMINAL EQUIPMENT

In this section we review the requirements for communication facilities and develop estimates for their costs.

COMMUNICATION NETWORK

The communication network developed for Phase II is based on four voice grade leased lines. While this particular network configuration was chosen to evenly distribute the load among the four lines, other configurations are possible. The final configuration should account for the special GSA and OGS mileage charges available to SUNY. These mileage charges are approximately 50 cents per mile, per month, although they are not available in some areas.

Preliminary discussions with the Office of General Services, Division of Communications, indicated that the cost for a suitable network would be approximately $1,600 per month. This cost was based on a configuration serving the 25 libraries planned for Phase II with full duplex voice grade circuits, and does not include the required modems.

For Phase III we have developed a cost estimate based on all libraries being served through regional message concentrators located at the four university centers. We estimate the total mileage required for the network configuration to be about 4,500 miles, and the monthly cost to be approximately $4,000. Again, the final network configuration should be developed in conjunction with the Division of Communications, Office of General Services.

TERMINAL EQUIPMENT

The terminal equipment for use in the individual library should have a transmission rate of at least 10 characters per second, and preferably 15 characters per second. The keyboard/printer should accommodate both upper and lower case character sets, and should have a pin-feed platen. An eight-level punched paper tape reader and punching device should work in conjunction with the keyboard/printer. We estimate the complete terminal rental, including the required modem, to be $150 per month.

The processor for use in Phase III as a remote multiplexor and message switching device would be responsible for continuous polling of the various lines and error checking. It would concentrate the messages from several libraries and transmit them over a single line to the center.

Each remote processor would cost about $1,500 per month.